TEK Instruction Manual

Part No. 070-2754-00
Product Group 20

TDC1 VHF AND TDC2 UHF
TUNABLE DOWN CONVERTERS

Please Check for
CHANGE INFORMATION
at the Rear of this Manual

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PREFACE

This manual documents the TEKTRONIX TDC1 and TDC2 Down Converters. The TDC1 and TDC2 are plug-ins for the TEKTRONIX 1450-1 Television Demodulator. The 1450-1 Instruction Manual should also be consulted for information about operating the TDC1 or TDC2 and the 1450-1 as a SYSTEM.

This preface describes the contents of the manual, with a brief description of each section within the manual.

The Table of Contents is a detailed list of all important pieces of information and their location in the manual.

The manual is split into two parts, Operator's and Service. All pertinent information regarding the operation of the instrument is located in the Operator's part. This will be of use to both the operator and the service technician. The Service part contains that information necessary to effectively service the instrument. This information should be useful only to qualified service technicians.

The Operator's part includes Sections 1 and 2:

Section 1—Introduction and Specifications includes a general description of the instrument, a safety summary, and the specifications.

Section 2—Operating Instructions includes information on installation, connectors, and operator familiarization.

The Service part contains Sections 3 through 9:

Section 3—Theory of Operation begins with a general overview of the instrument, followed by a detailed circuit description.

Section 4—Calibration includes a Performance Check and an Adjustment Procedure, and an equipment list.

Section 5—Maintenance covers the standard electrical and mechanical maintenance; plus any special tools, unusual components, and special handling.

Section 6—Options documents any options available with the instrument.

Section 7—Replaceable Electrical Parts list includes ordering information and part numbers for all replaceable electrical parts.

Section 8—Diagrams includes a Block Diagram, Schematics, Circuit Board Illustrations, component basing diagrams, waveforms, parts locating charts, and adjustment location illustrations.

Section 9—Replaceable Mechanical Parts list refers to an exploded view drawing of the instrument, and lists ordering information for all replaceable mechanical parts.

Change and correction information after the manual has been printed is located behind a tabbed page at the rear of the manual.

The text and diagrams are in accord with, and based on the following standards of the American National Standards Institute, Inc. (ANSI):

ANSI Y1.1—1972, Abbreviations
ANSI Y32.2—1975, Graphic Symbols
ANSI Y32.14—1973, Graphic Symbols (Logic)
ANSI Y32.16—1975, Reference Designators

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WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

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OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

TERMS

In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SAFETY CONSIDERATIONS

Power Source

This product is intended to operate from dc supplies in a mainframe whose power source will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord of the mainframe is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord in the mainframe. To avoid electrical shock, plug the mainframe power cord into a properly wired receptacle before connecting to the mainframe input terminals. A protective ground connection by way of the grounding conductor in the mainframe power cord is essential for safe operation.

Do Not Operate In Explosive Atmospheres

To avoid explosion, do not operate this product in an atmosphere of explosive gases unless it has been specifically certified for such operation.

Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

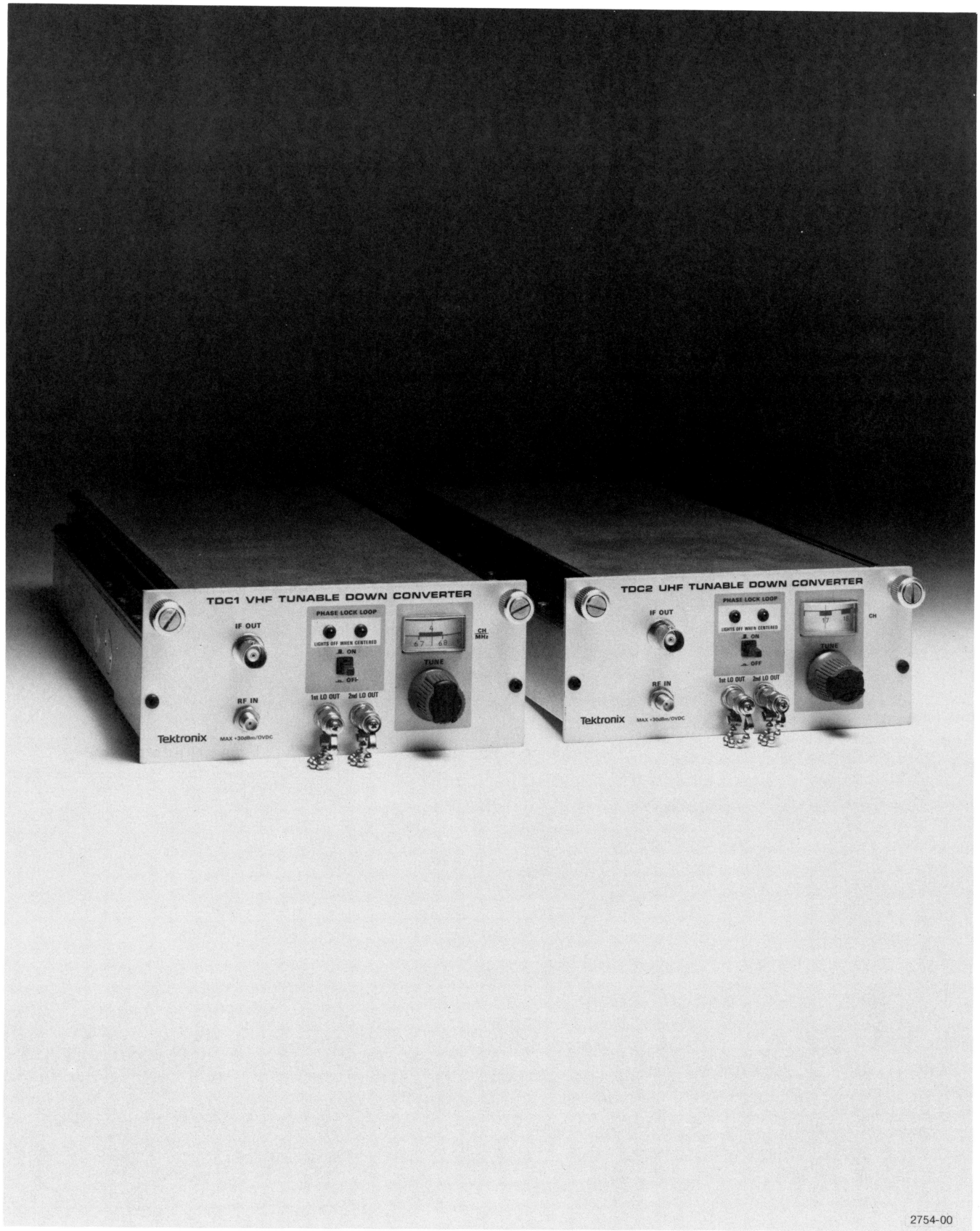


Fig. 1-1. TDC1 and TDC2 Tunable Down Converters.

PART 1
OPERATOR'S INFORMATION

INTRODUCTION AND SPECIFICATION

INTRODUCTION

The TEKTRONIX TDC1 and TDC2 (Television Down Converters) are high performance plug-in front ends for the TEKTRONIX 1450-1 Television Demodulator. The SYSTEM provides an accurate means of analyzing a television transmitter.

The TDC1 and TDC2 are interchangeable to provide multi-channel operation of the 1450-1. The TDC1 covers Channel 2 through Channel 13 (vhf) and CATV Channels A through W, while the TDC2 covers Channel 14 through Channel 83 (uhf).

Phase-lock-loop frequency control circuitry allows the TDC1 and TDC2 to have crystal-controlled stability of the local oscillator. The TDC1 and TDC2 provide selectivity around the channel frequency, convert each channel to an intermediate frequency (if) compatible with the 1450-1, and limit the if feedthrough and image frequencies.

A wide agc range accepts large signals from transmitter test points, or weak signals from an antenna for remote monitoring; all without affecting the bandpass characteristics of the 1450-1/TDC1 or 1450-1/TDC2 system.

SPECIFICATION

Table 1-1

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Down Converter		
RF IN		
Z_{in} and connector		50 Ω sma
Return Loss	10 dB or greater	30 dB or greater with 20 dB attenuation
Frequency		
Phase-locked	Single channel ±20 kHz from nominal carrier frequencies	
Not Phase-locked	54 MHz to 300 MHz (VHF) 470 MHz to 890 MHz (UHF)	
Input Level Range	−66 dBm to 0 dBm	
1st IF Image Rejection Ratio	50 dB or greater—VHF 40 dB or greater—UHF	
2nd IF Image Rejection Ratio	60 dB or greater	
1st IF Rejection Ratio	50 dB or greater—VHF 30 dB or greater—UHF	

Table 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
Down Converter (cont)		
IF OUTput		
Z_o and Connector		50 Ω bnc
Level	−64 dBm (with −65 dBm RF input level) to −20 dBm (with −21 dBm to +1 dBm input level) ±1 dB	Mainframe readout calibrated for TDC1/TDC2
Frequency (Visual IF)		
Option 1	37.0 MHz ±120 kHz	
Option 2	38.9 MHz ±120 kHz	
Option 3	45.75 MHz ±120 kHz	
Aural IF		4.5 MHz below Visual IF
1st LO OUTput		
Z_o and Connector		50 Ω sma
Frequency		
VHF	Channel rf visual carrier plus 436.75 MHz ±90 kHz when phase-locked	492 to 732 MHz
UHF	Channel rf visual carrier plus 440.75 MHz ±90 kHz when phase-locked	912 to 1326 MHz
Level		+10 dBm nominal
2nd LO OUTput		
Z_o and Connector		50 Ω sma
Frequency		
VHF Option 1	399.75 MHz ±10 kHz	
Option 2	397.85 MHz ±10 kHz	
Option 3	391 MHz ±10 kHz	
UHF Option 1	403.75 MHz ±10 kHz	
Option 2	401.85 MHz ±10 kHz	
Option 3	395 MHz ±10 kHz	
Level		−5 dBm nominal
Down Converter AGC Range	0 to 22 dB	
2nd Order Input Intercept Point	+50 dBm	
3rd Order Input Intercept Point	+5 dBm	
Variation in Down Converter Frequency Response as a Function of AGC	±0.25 dB or less over a 6 MHz Bandpass	

Table 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
SYSTEM (1450-1 and Down Converter combination)		
RF Attenuator Range (Attenuator in 1450-1 Mainframe)	30 dB in 10 dB steps	Input level range shifts with attenuator (−56 dBm to +10 dBm with 10 dB attenuation −46 dBm to +20 dBm with 20 dB attenuation)
Noise Figure	19 dB or less	
Ultimate Signal-to-Noise Ratio	58 dB or better	Typically 60 dB
Low-Frequency Phase Noise	0.5 degrees rms or less when the Down Converter is phase-locked	As measured with mainframe (1450-1) Quadrature output
AGC Range	66 dB	
Adjacent Channel Cross-modulation	60 dB or greater down	Adjacent channel signal less than or equal to the desired channel signal
2nd Adjacent Channel Cross-modulation	60 dB or greater down	2nd adjacent channel signal less than or equal to the desired channel signal
Variation in SYSTEM Frequency Response Across any 6 MHz Channel Bandpass	±0.3 dB or less	
Chrominance/Aural Carrier/Visual Carrier Intermodulation	50 dB or greater down	"Standard" 3-Tone Test p-p Video/p-p 920 kHz

Table 1-2

ENVIRONMENTAL CHARACTERISTICS

Characteristic	Supplemental Information
Temperature	
Operating	0°C to 50°C
Storage	−50°C to +65°C
Altitude	
Operating	To 15,000 feet
Storage	To 50,000 feet

Table 1-3

PHYSICAL CHARACTERISTICS

Dimensions	
Length	11.125 inches (28.3 cm)
Width	6.1 inches (15.5 cm)
Height	2.6 inches (6.6 cm)
Weight	5 pounds (2.3 kg)

OPERATING INSTRUCTIONS

This section includes information on installation and controls and connectors.

SHIPPING CARTON

At installation time, save the shipping carton and packing materials for repackaging in case reshipment becomes necessary. See the Maintenance section of this manual for repackaging instructions.

SERIAL NUMBER

The serial number tag is located at the bottom left edge of the down converter. This tag lists the instrument serial number, the options, CCIR System (M, B, or G), and IF. See Fig. 2-1. Provide the information on the serial number tag whenever communicating with your service center or field representative.

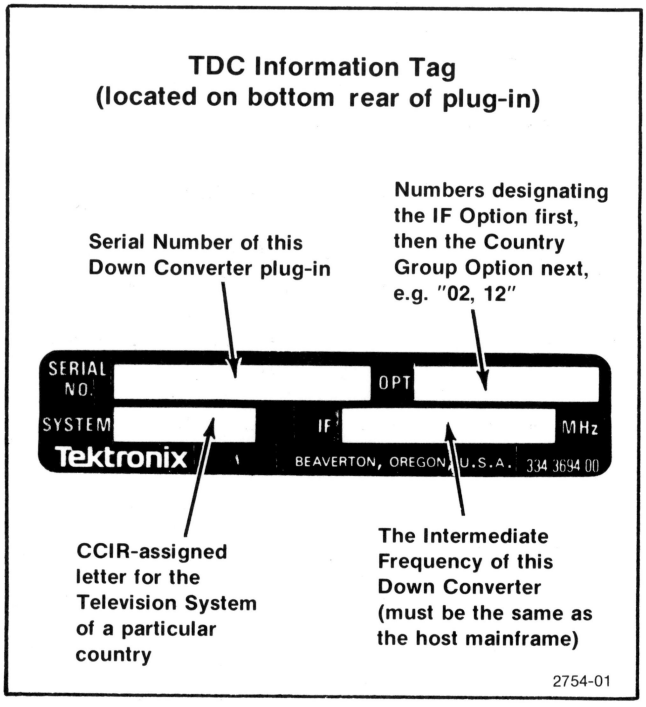


Fig. 2-1. Serial Number Tag.

INSTALLATION

Slide the TDC1/TDC2 (Television Down Converter) into the slot in the 1450-1. Be sure that the down converter is firmly seated, then secure it in place with the two thumbscrews. See Fig. 2-2.

Using the 50 Ω bnc and sma cables from the 1450-1 accessories kit, connect the rf and if signal lines between the mainframe and the TDC1/TDC2. The sma connectors should be tightened at least finger tight, and preferably a little tighter, using a 5/16-inch open end wrench.

Remove the top cover from the 1450-1, and locate two sets of switches on the Readout Driver board (A61). The switches are in dual-in-line (dip) packages that are slightly shorter than a 14-pin dip Integrated Circuit (IC). See Fig. 2-2. Check to see if these switches are set according to Fig. 2-2, and if they are not, reset them. When these switches are set correctly, the 1450-1 RF Signal Input Level readout will indicate the correct RF Input signal level.

CONNECTORS

Refer to Fig. 2-3 for the location of the controls and connectors.

RF IN—50 Ω sma connector accepts the rf through from the 0 to 30 dB attenuator via the sma-to-sma double-shielded cable and the front-panel RF OUT connector. Input range to this connector is −65 dBm to −1 dBm.

IF OUT—50 Ω bnc output connected to the IF IN via a 50-ohm bnc-to-bnc cable. Output level is −20 dBm to −64 dBm depending upon the rf input level and the 1450-1 agc.

1st LO OUT—A 50 Ω output, sma connector, available for use in performance checks and calibration. The nominal output level is +10 dBm.

2nd LO OUT—A 50 Ω output, sma connector, available for use in performance checks and calibration. It has a nominal output level of −5 dBm.

The 1st LO and 2nd LO are mixed in a test modulator.

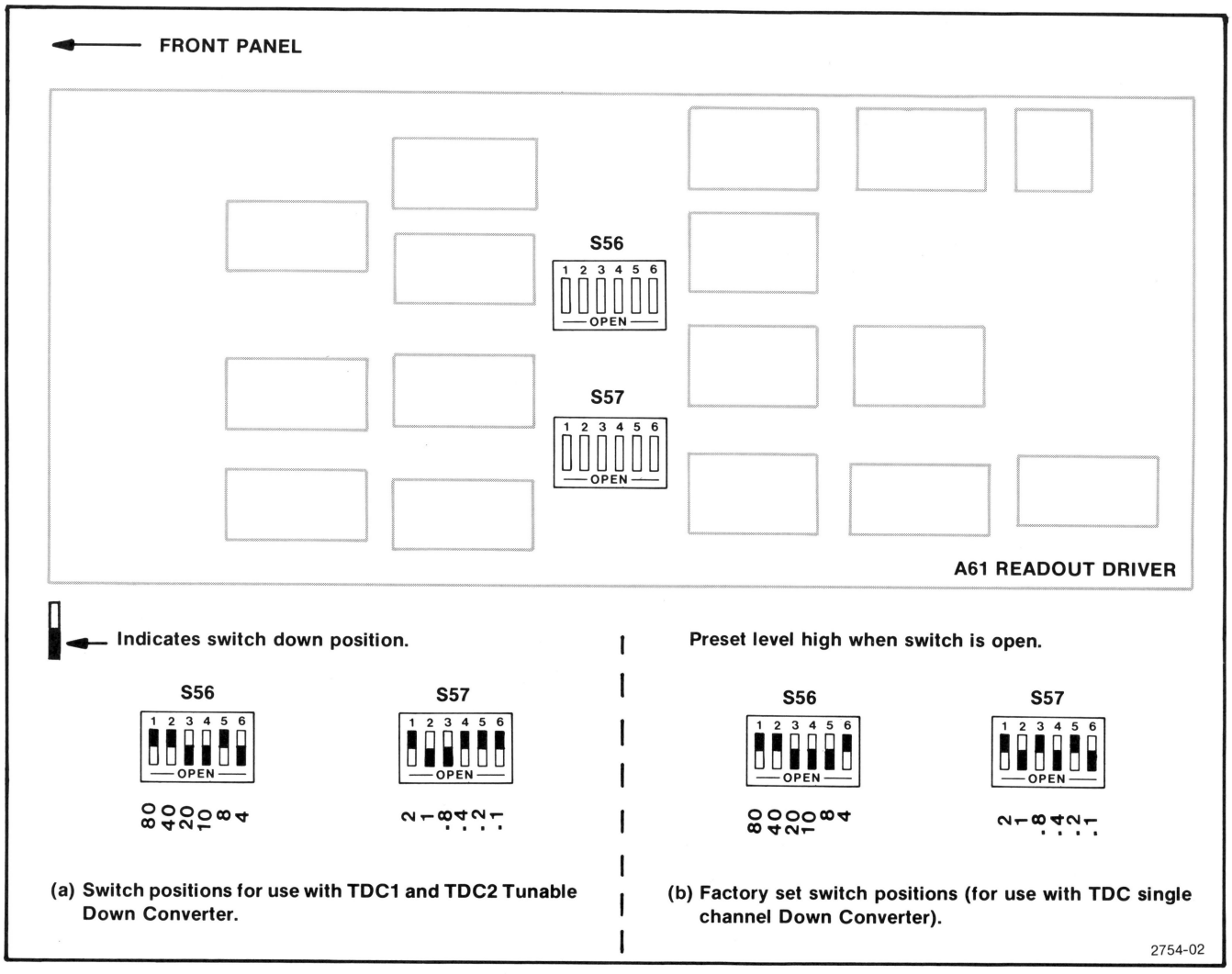


Fig. 2-2. 1450-1 Readout Offset for the TDC1 and TDC2.

The resulting auxiliary local oscillator signal is then used to derive the visual carrier for the channel at which the TDC1 or TDC2 is set.

Fig. 2-3. Controls and connectors.

APPLYING A SIGNAL

The RF IN impedance to the TDC1/TDC2 is 50 Ω. At high frequencies, impedance mismatches between the RF IN and the signal source can cause reflections in the transmission line, and degrade instrument performance. To reduce mismatch, use good quality 50 Ω coaxial cable to connect the signal source to the RF IN, and keep the cable as short as possible to reduce cable losses.

The TDC1/TDC2 can be used with a 75 Ω signal source by using a 75 Ω-to-50 Ω minimum loss pad or matching transformer. If an antenna is used, its bandpass characteristics should be known. Most receiving antennas response characteristics are not as flat at the 1450-1/TDC1 or 1450-1/TDC2 combination; therefore, the antenna characteristics should be figured when making over-the-air type measurements.

Sensitivity and power levels are often rated in dBm (dB with reference to 1 mW, regardless of impedance). Sensitivity and power levels for 75 Ω systems are usually rated in dBmV (dB with reference to 1 mV across 75 Ω). Figure 2-4 gives a convenient chart for converting volts to dBm to watts. To convert dBm to dBmV, add 48.75 to the dBm value.

Signals fed to the TDC1 or TDC2 should be between −65 dBm and +1 dBm. The 1450-1 front-panel 10 dB and 20 dB attenuators may be switched in to accept signals to +31 dBm. If signals larger than +31 dBm are encountered at transmitter test points, external pads should be inserted to bring the signal within the agc range.

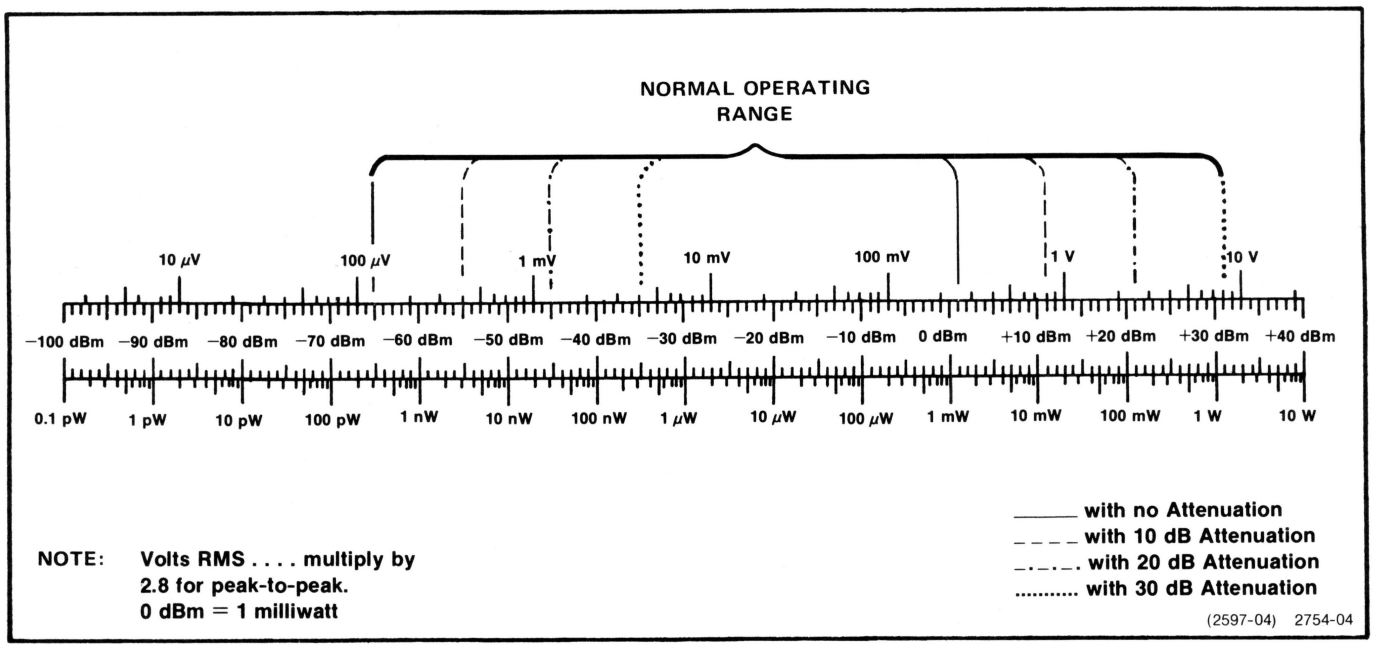


Fig. 2-4. Volts-dBm-Watts Conversion Chart for 50 Ω Impedance.

PART II
SERVICE INFORMATION

THEORY OF OPERATION

This section includes a block diagram description and a detailed circuit description. The descriptions apply to both versions of the down converter.

Separate descriptions are used where circuits change between the two versions.

BLOCK DESCRIPTION

The TDC1/TDC2 provides the rf-to-if conversion for the 1450-1 Television Demodulator. The TDC1 covers channel 2 through channel 13 and the CATV channels A through W (vhf), while the TDC2 covers channel 14 through channel 83 (uhf). The down converter plugs into the 1450-1, where power supply and control lines are connected via a circuit-board edge connector. RF and if signal lines are brought back via front-panel coaxial connectors. A detailed block diagram in the Diagrams section illustrates signal paths and function of the major circuits. Refer to this diagram while reading the description.

The rf input signal is fed to the rear-panel of the 1450-1. A 10 dB and a 20 dB attenuator may be switched into the singal line for large signals. After the attenuator, the signal is fed by coax cable from the 1450-1 front panel to the TDC1/TDC2 front panel.

Inside the TDC1/TDC2, circuits are isolated from each other by extensive shielding and decoupling. The signal is fed through a bandpass filter to reduce out-of-band signals. The filter is flat from 50 MHz to 300 MHz in the TDC1, and from 470 MHz to 890 MHz in the TDC2.

A variable PIN diode attenuator, controlled by the 1450-1 agc circuit, follows the bandpass filter. The attenuator is one of three used in the 1450-1 system to provide a wide agc range. The one in the TDC1/TDC2 is engaged only for large rf input signals. This allows the front end to be operated at full gain for weak signals, maintaining the best signal-to-noise ratio. Control information for the agc is fed from the 1450-1 mainframe to the TDC1/TDC2 in digital form, corresponding to steps of attenuation. The PIN Driver circuit translates this digital information into analog currents to drive the PIN diodes in the attenuator circuit. The PIN Driver board is custom calibrated to match the specific set of PIN diodes.

NOTE

PIN Driver and PIN Attenuators: New Programmable Read Only Memories (PROM) must be programmed if one of the old PROM or precision resistors on the PIN Driver board, or a PIN diode and associated circuitry in the PIN Attenuator circuit needs to be replaced. Because each PROM program is unique, the PROMs and PIN diodes are not directly replaceable. The affected boards are A2 and A12 in the TDC1/TDC2. See the Replaceable Electrical Parts list for replacement information.

The 1st Mixer converts the rf signal to the 1st Intermediate Frequency (if), namely 436.75 MHz in the TDC1 and 440.75 MHz in the TDC2. The 1st Local Oscillator (lo) signal and the rf signal are mixed in a diode-ring mixer, resulting in the 1st if difference signal. The 1st if out from the mixer drives a helical-resonator filter.

The 1st LO signal is generated by a mechanically tuned oscillator in the 1st LO (A8). The 1st LO feeds the lo return to the Sampling Phase Detector in the rf phase-locked loop. The 1st LO signal phase is sampled at the Crystal Reference Oscillator frequency. The output of the Phase Detector is amplified and fed back into the 1st LO to bring the frequency into phase lock with the Crystal Reference Oscillator. A Search Oscillator initially causes the 1st LO to sweep through its frequency range. This brings the local oscillator frequency close enough to the multiple of the Crystal Reference Oscillator for the phase-lock circuit to take control. After the initial sweep, the Search Oscillator circuitry is used as an amplifier for the 1st LO control voltage (Vc).

The phase-locked LO signal drives the 1st Mixer through an amplifier.

The 1st IF signal drives the IF Amplifier through a helical resonator filter. The IF Amplifier is a broadband type with 21 dB of gain. The IF Amplifier drives the 2nd Mixer through another helical resonator filter.

The 2nd Mixer converts 1st IF to the specified if (37 MHz/Option 1, 38.9 MHz/Option 2, or 45.75 MHz/Option 3). The 1st IF signal and the 2nd LO signal are mixed in a diode-ring mixer resulting in the specified if difference signal. This if signal is passed through a low-pass filter to the front panel, and is labeled IF OUT. The IF OUT amplitude is −20 dBm for all rf-input signals between +1 dBm and −21 dBm; and decreases as the rf-input signal level for all levels less than −21 dBm.

The 1st LO signal and the 2nd LO signal are available at the front panel.

Glossary

There are several components and circuits used in the TDC1/TDC2 that may be considered new or unusual by many technicians. To aid in understanding these circuits, this brief glossary is included.

Chip Components—Resistors, capacitors, and transistors designed for use in high-frequency circuits. They usually consist of very small ceramic bodies with short leads or terminals mounted on the body. They are used where stray reactances are to be kept to a minimum.

Helical Resonator—High Q, low loss, resonant section of helically-wound transmission line. This electrically resembles a quarter-wave section of transmission line, but is physically much smaller. It is constructed as a helically-wound coil, mounted in a shield cavity. The coil is grounded on one end, and open on the other.

Microstrip—A section of etched-circuit board designed to act as a transmission line between circuits on the board. Impedance of the microstrip is determined by the size and separation of the signal-carrying conductor and the ground-plane conductor.

PIN Diode—A diode with a large intrinsic layer between the p and n layers. At high frequencies, the PIN diode looks like a resistance, variable with the dc current through it. This makes the PIN diode very useful in high-frequency attenuator applications.

PROM—Programmable Read Only Memory. The memory output for each address is programmable. This allows a custom program to be entered into permanent memory.

DETAILED CIRCUIT DESCRIPTION

RF SIGNAL PATH PROCESSING SYSTEM ◇1◇ V and ◇1◇ U

RF PIN Attenuator (A2V and A2U)

NOTE

The letter "V" immediately following an assembly number indicates an assembly used in the TDC1 only, and the letter "U" after an assembly number indicates an assembly used in the TDC2 only.

The RF PIN Attenuator, A2, contains a wideband filter which passes only signals in the vhf band for the TDC1 or the uhf band for the TDC2.

The variable RF PIN Attenuator, A2, uses the rf resistance characteristics of PIN diodes to form an attenuator. The PIN Driver circuit, A12, controlled by the agc circuit in the 1450-1 mainframe, determines the amount of attenuation, and compensates for the nonlinear resistance characteristic of the PIN diodes.

NOTE

To maintain accuracy should a PIN diode in the attenuator, or a PROM in the PIN Driver circuit fail, we recommend that the down converter be returned to Tektronix for repair and recalibration. See the Maintenance section of this manual for further information.

The PIN Attenuator, A2, is a pi type attenuator. CR64 (CR74 in TDC2) is the series element; and CR66 and CR76 are the shunt elements. The capacitors and inductors provide the rf and dc paths, respectively.

Microstrip circuit-board transmission-line runs are used in both the vhf and uhf PIN Attenuators. Placed in the rf signal path, the microstrips maintain constant impedance to the signal.

1st IF Mixer (A3V and A3U)

The RF Mixer board (A3) contains a LO Amplifier and the mixer circuit (see Fig. 3-1). The rf signal is mixed with the 1st Local Oscillator (1st LO) signal, to produce the 1st Intermediate Frequency (1st IF). The 1st IF signal is equal to the difference between the 1st LO and the RF signal.

The rf signal is fed to the mixer at P81 on A3. The circuit at this input matches the impedance of the rf-signal port to that of the 50 Ω PIN Attenuator (A2) circuit. In the TDC1 L52, and C51, matches the input for 50 MHz through 300 MHz (channels 2 through 13 including CATV channels A through W). In the TDC2, the network consisting of L51, C51, and C52 matches the input for 470 MHz through 890 MHz (channels 14 through 83).

The LO Amplifier is similar to those described in the IF Amplifier (A5). The lo input from the 1st LO (A8), is at +10 dBm. The LO Amplifier supplies 10 dB of power gain, so that a total of +20 dBm is available at the output of the LO Amplifier.

The output of the LO Amplifier is attenuated approximately 1.5 dB by R55 and R54, then fed to the primary of T63. R55 improves the mixer performance.

High local-oscillator power gives a high mixer output intercept point, and therefore helps maintain a high dynamic range. The mixer is a diode ring, using four hot-carrier diodes in one microstrip package.

The mixer is driven through T63 with the 1st LO signal at a high power level. This switches the diodes on and off at the 1st LO rate. The rf signal is fed via the secondary of T63. The diode ring switches the primary leads of T75 so that the difference between the lo and rf is present at the output end of T75's secondary. This is the 1st IF. The rf and 1st LO components at P85 will be reduced by the balanced mixer. (See Fig. 3-2.)

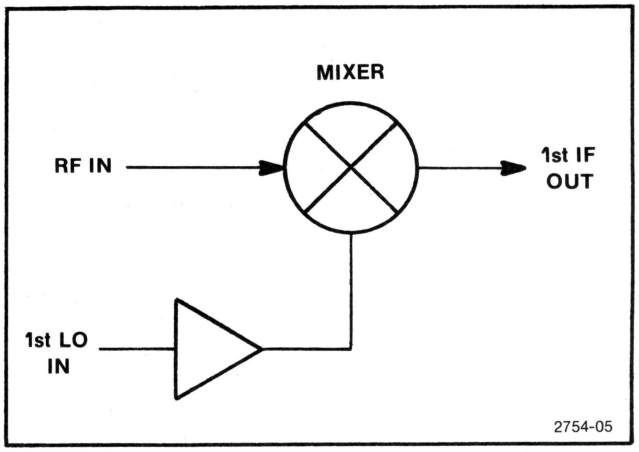


Fig. 3-1. Mixer board block diagram.

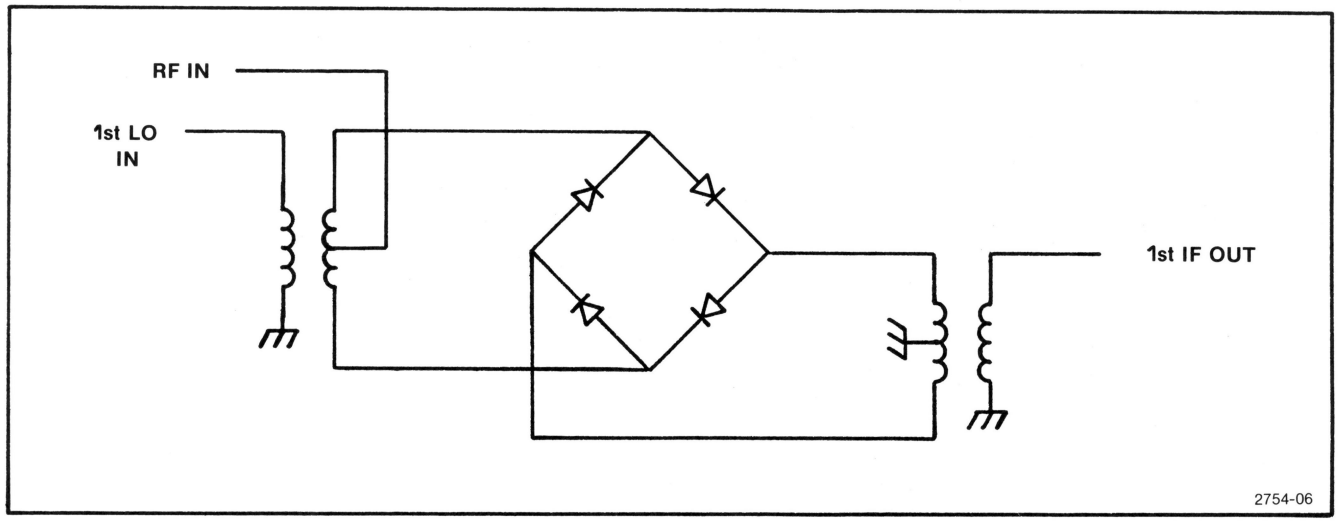


Fig. 3-2. RF mixer circuit.

Bandpass Filters (A4, A6)

The Bandpass Filters are used to reject out-of-band signals while providing flat response for the desired channel frequencies. They are two-section helical resonator filters. Each helical resonator electrically looks like a quarter-wavelength section of transmission line, shorted on one end, and open on the other. This provides a high unloaded Q in a small space. The filters input and output see 50 Ω impedances (see Fig. 3-3), and the tap points are set to provide the loaded Q required for a flat-bandpass response.

The resonators are coupled by C55, a specially made capacitor consisting of spring-metal plates, capacitively coupled to the resonator coils. C55 has one plate for each resonator coil (see Fig. 3-4). The total coupling to each resonator is increased or decreased as the distance from the plates to the coil changes.

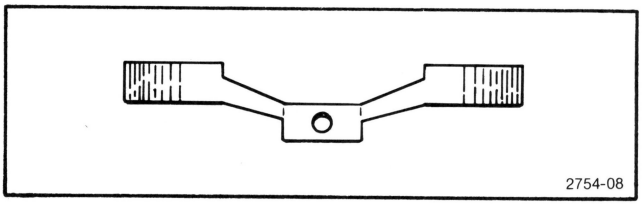


Fig. 3-4. Bandpass filter coupling capacitor C55.

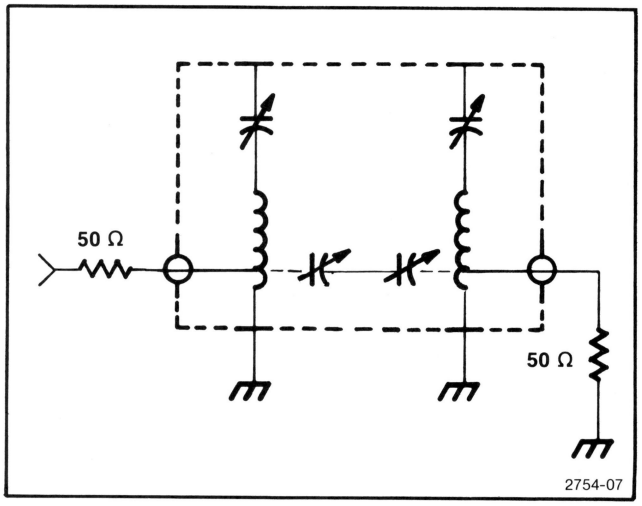


Fig. 3-3. Simplified bandpass filter diagram.

1st IF Amp (A5)

The 1st IF Amplifier, A5, provides 21 dB of power gain to the 1st IF signal. In addition, the amplifier provides reverse isolation to reduce interaction between the two helical filters. The reverse isolation also reduces possible reradiation of the 2nd LO and 2nd IF back of the down-converter input.

The amplifier has three stages. The first stage, Q26 and Q22, has 8 dB of power gain. Q22 sets the bias for Q26. Voltage divider, R10 and R11, sets the base, and thus the emitter voltage of Q22. The constant voltage on the emitter of Q22 sets the current through R32. Almost all of this current flows through the collector of Q26, and the remainder flows through Q22 to the base of Q26. The

individual transistor betas determine the actual division of current. Thus, Q22 regulates Q26's collector current by measuring the voltage drop across R32.

The rf gain for the first stage is determined by the values of the emitter resistors R27 and R28, feedback resistor R26, and the associated microstrip transmission lines.

The second stage consists of Q56 and Q42, and has 8 dB of power gain. It is biased much the same as the first stage. The rf gain of the second stage is determined by the emitter resistors R57 and R58, the collector load resistor R75, and the associated microstrip transmission lines.

The third stage consists of Q76 and Q73. It is biased similar to the first two stages, and has 5 dB of power gain as determined by emitter resistors R76 and R86.

Microstrip transmission-line circuit-board runs and chip components are used where appropriate to maintain constant impedance for the rf signal.

2nd Mixer (A7)

The 2nd Mixer board (A7) contains an input and output attenuator, a balanced mixer, and a low-pass filter. The 1st IF signal is mixed with the 2nd LO signal to produce the 2nd IF signal (IF OUT at the front panel).

The 1st IF signal is fed to the 2nd Mixer at P77. The attenuator circuitry R77, R68, and R67 at this input isolates the mixer from the input, and reduces unwanted mixing products. This circuitry has an insertion loss of about 2 dB.

High 2nd LO power level gives a high mixer output-intercept point, and therefore helps maintain a high dynamic range. The mixer contains a diode ring, using four hot-carrier diodes in one microstrip unit.

The mixer is driven through T37 with the 2nd LO signal at about +18 dBm. This switches the diodes on and off at the 2nd lo rate. The 1st IF signal is fed to the mixer through T57. The diode ring switches the secondary leads on T57 so that the difference between the 2nd LO and the 1st IF is present at the center tap of T57. This is the 2nd IF (IF OUT). The 1st IF and 2nd LO components at J01 (IF OUTput) will be reduced by the balanced mixer and the low-pass filter consisting of C41, L41, C31, L21, and C21.

The variable-attenuator circuit at the output leads of T57 allows varying the IF OUTput about 1.5 dB. R53 (if Level) is used to set the overall gain of the down converter at +1 dB.

The low-pass filter C41, L41, C31, L21, and C21 passes the specified if signal, and rejects high-frequency products from the mixer. P13 on A7 connects the mixer output to the front panel.

VHF AND UHF 1st LO SYSTEM ② V AND ② U

1st LO (A8V and A8U)

The 1st LO is a mechanically-tuned oscillator having three outputs (1st LO OUTPUT, 1st LO Return, and a 1st LO signal to drive the Mixer) and one input (Vc).

The 1st LO OUT frequency is equal to the sum of the 1st IF visual carrier and the visual carrier of the channel to which the down converter is tuned. This output may be mixed with the 2nd LO in an external mixer, and used to drive a test modulator.

The 1st LO Return output is used to phase-lock the 1st LO to a harmonic of the crystal oscillator in the phase-lock loop circuit.

The third output is mixed with the incoming rf signal to derive the 1st IF signal.

The input signal (Vc) is a dc-coupled signal used to control the frequency of the 1st LO. It determines whether the 1st LO is phase-locked or not.

1st LO PLL (A9)

The RF PLL board (A9) phase locks the 1st LO to a crystal-reference oscillator. The board contains the crystal oscillator, a sampling phase-detector, and a loop amplifier. (See Fig. 3-5.)

The crystal oscillator generates the reference frequency for the phase-locked loop. The oscillator is basically a Pierce, or crystal-type Colpitts, oscillator, with Y02 or Y07 determining the frequency, and Q37 the active component. The crystal frequency is chosen so that a harmonic falls within 100 kHz of the desired 1st LO frequency. For example; a down converter tuned to channel 2 (1st LO = 492 MHz) has a crystal frequency of 6.000 MHz. The 1st LO is phase locked to the 82nd harmonic of the crystal frequency, so the lo frequency is 492 MHz. When mixed

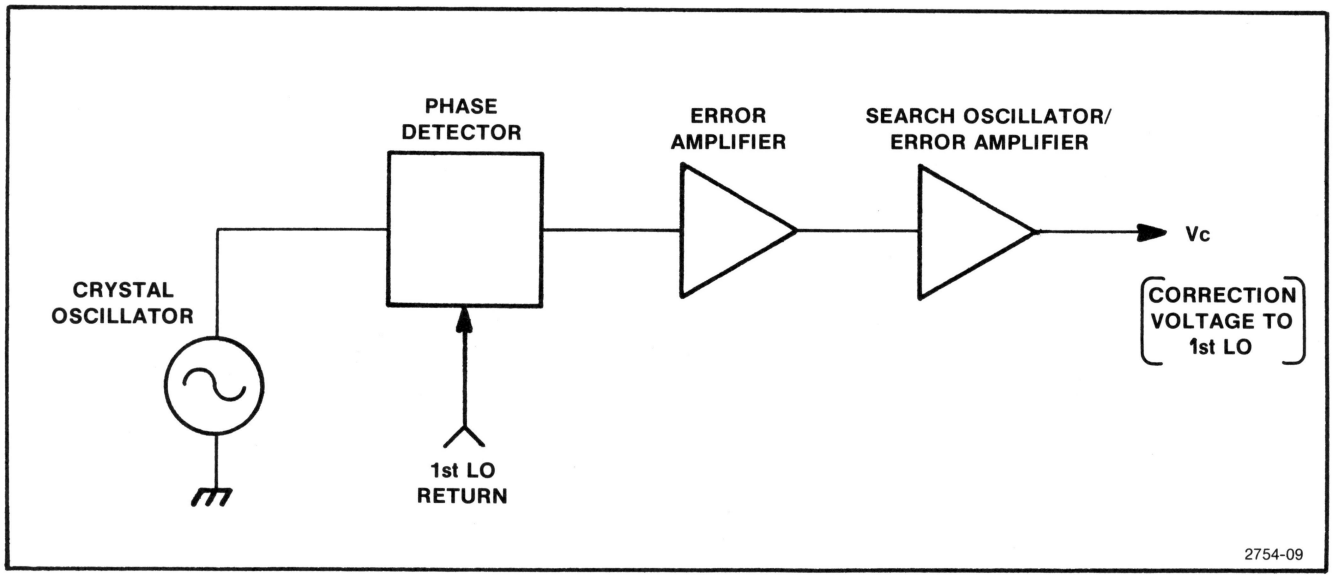


Fig. 3-5. 1st LO phase lock loop block diagram.

with the 55.25 MHz channel 2 visual carrier, this produces an if output at 436.75 MHz.

Y02 is active for channels 2 through 4 and 7 through 13 including the CATV channels A through W, while Y07 is active for channels 5 and 6. See the discussion on the Indicator Board (A10).

The crystal oscillator conducts for a small portion of each cycle, with Q37 turned off until the positive-going cycle of the signal at the base causes the transistor to conduct. The output of the crystal oscillator is shaped by snap-off diode CR36. The snap-off diode holds the positive-peak voltage of the crystal-oscillator output constant by conducting current to ground from R44. This voltage remains unchanged until after Q37 starts to conduct. For a short time after Q37 turns on, the snap-off diode continues to conduct in a negative direction, then sharply turns off. This causes an abrupt voltage change at the negative transition. The fast negative-going edge of the signal is passed by C98 to the primary of T47. This looks like a differentiator or high-pass filter, so that only a negative-going pulse is applied to the transformer.

T47 provides differential drive to the double balun[1] transformer T57. The 1st LO signal is fed to the opposite end of the baluns. The baluns serve to isolate the 1st LO signal from T47, and provide a ground reference for the sampling pulses.

CR52 and CR56 are forward biased by the peak of the sampling pulses. The level of the sampling pulses, plus the sampled 1st LO level, charges C67 positively, and C68 negatively. Since the sampling pulses are equal absolute amplitudes, the average level is simply the sampled level, C57 and the input capacitance of fet Q76A charge to the average level of the 1st LO at the time of the sampling pulse. If the 1st LO is phase locked, the sampling pulse will occur at the same level all of the time. If the 1st LO is not yet phase locked, the level will change from sample to sample, thus generating an ac signal with a frequency equal to the difference of the 1st LO and the nearest harmonic of the crystal oscillator. This becomes the correction voltage to pull the 1st LO closer to phase locking. (See Fig. 3-6.)

The Loop Amplifier has three stages; the input buffer, operational amplifier, and the search oscillator. Q76A and B act as a high input-impedance buffer for the control voltage. U62 is connected as an inverting operational amplifier, with a voltage gain of about 100 (R53/R64). R63, PII Gain, located at the output of U62, is normally set so that the wiper is at or near the amplifier end of the pot. When testing or troubleshooting the Phase-locked Loop, the loop may be opened by setting the wiper of R63 to the ground end.

U82 is connected as a Wien-bridge oscillator, and acts as a search oscillator and part of the loop amplifier. When the down converter is first turned on, the search oscillator sweeps the 1st LO to bring the frequency within the range of the Phase-locked Loop. As the 1st LO approaches phase lock with the crystal-oscillator frequency, the

[1] **Balum is an acronym for BALanced-UNbalanced.**

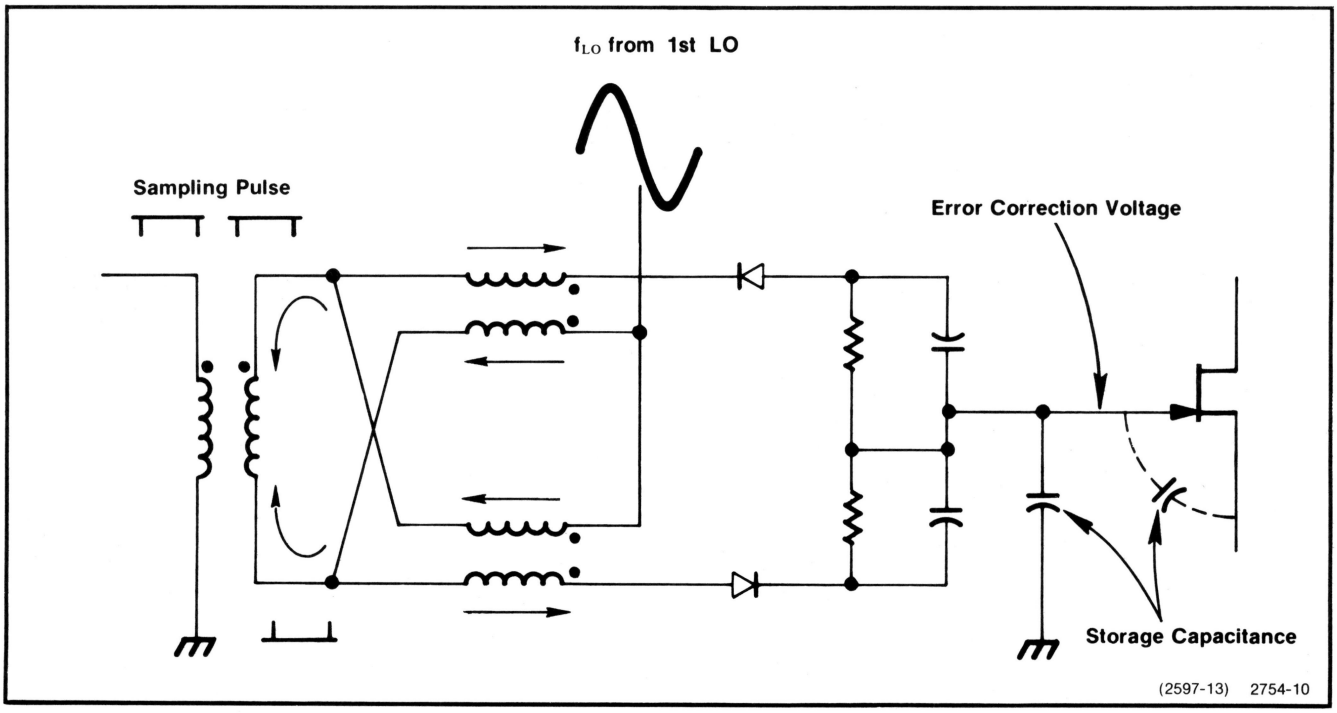


Fig. 3-6. Phase sampler operation.

search oscillator stops its sweep and operates as a unity-gain operational amplifier for the control voltage.

C93, R84, C86, and R97 set the search-oscillator frequency to about 10 Hz. CR94, CR93, and R93 limit the output voltage swing to a minimum of about 0 volts. When the 1st LO frequency approaches phase locking, the negative feedback of the total loop overcomes the positive feedback of the search oscillator, stopping the search oscillator. It then acts as an output buffer for the loop amplifier. C72 and R80 act as a filter to limit the loop bandwidth to about 15 kHz. S76 (PLL ON/OFF) can be pushed in during testing or troubleshooting to stop the search oscillator. R62, Offset Voltage, is set when S76 is pushed in, to center the 1st LO control voltage range. The output of U82 is the 1st LO control voltage, and is fed to the 1st LO (A8V or A8U) through the Indicator Board (A10V or A10U).

Indicator Board (A10V and A10U)

This board indicates the phase-locked loop centering information, and provides the PLL board reference crystal switching in the TDC1 (VHF PLL board only).

S76 switches the phase-locked loop on and off. In the PLL OFF position (PLL switch in/switch light on), S76A is open, disengaging the search circuitry on the PLL board; S76B applies about +7 V to P80-1 (Vc on the 1st LO) and to U60A and B; S76C turns off both crystals on the PLL board, and turns on the switch light.

The circuitry consisting of U60A and B, Q96, Q97, and the front-panel LED assures that the signal Vc is tuned (with the TUNE control) to the center of its 0- to 12-volt range when both LED are off, and the phase-locked loop is on. U60 forms a dual comparator. It compares the voltage applied to Vc on the 1st LO with set voltages from divider R57, R67, and R53. When the voltage on pins 3 and 6 of U60A and B is 6 to 8 volts, the comparators keep Q97 and Q96 off, and the LED are not lit. When this voltage increases or decrease (or oscillates as when the phase-locked loop is in a search mode) the LED will switch on and off alternately.

In vhf down converters (TDC1), a different crystal is required for channels 5 and 6 (see PLL board description). The switching of crystals on the PLL board is accomplished through the circuitry consisting of U5A and b, and associated parts. U5B is an oscillator with the frequency set by C17 and R17. This frequency modulates the reflective optical coupler (Q25) through Q21. If there is a black strip in front of Q25 on the dial tape, no light is reflected, and pin 1 of U5A is at 0 volts, Q28 is off, Q35 is on, and Q23 is on. This applies +15 volts to P80-6, selecting the 6-MHz crystal. When there is a white strip on the dial tape in front of Q25, the modulated light is being reflected, switching the opto-transistor. C50/R31 creates an RC filter of the frequency of modulation (about

1.2 kHz). This signal (a semi-square wave) is applied to U5A (which works as a comparator) and causes pin 1 of U5A to produce strong square waves. This is rectified and filtered by CR27, R18, and C27; then switches Q28 on, Q45 on, applying +15 volts to select the 5.977 MHz crystal on the PLL board (A9).

In the case of uhf units, this circuitry is not provided. A shorting strap is used where the collector and emitter of Q23 is located, thus applying +15 volts to only the 6-MHz crystal on the PLL board (A9).

VHF AND UHF LO SYSTEM ③

2nd LO (A11)

The 2nd LO contains a crystal oscillator and two class C amplifiers whose outputs are tuned to the third harmonic of the crystal. The input to the second amplifier is also tuned to the third harmonic.

This board has two outputs; one available at the front panel 2nd LO OUT, and the second output is used to mix with the 1st IF signal in the 2nd Mixer board to derive the 2nd IF (IF OUT).

Y05 is an overtone crystal, which together with Q25 and the associated circuitry comprises the oscillator. Variable capacitor, C26, optimizes feedback at the desired crystal frequency. That is, the series components C26 and L17 are resonant at the crystal frequency when C26 is properly adjusted. The crystal frequency is indicated on schematic number 3.

Q25 and Q24 are connected to form a cascode amplifier. The output load C12 and L21, is resonant at the overtone crystal frequency; also C51 and L41 are resonant at this frequency. The result is that the crystal frequency is coupled to the base of Q71.

Q71 and Q96 are class C amplifiers. Their output loads are resonant at 3X crystal frequency when C70, C80, C85, and C78 are adjusted correctly. The output of Q71 is inductively coupled to the base of Q96 through L72 and L82. L82 and C80 are also resonant at 3X crystal frequency. The output of Q96 is coupled to the 2nd Mixer and the front panel through L87 and L76. This output is attenuated approximately 2 dB by R67, R57, and R58 before it is fed to the 2nd Mixer board. This output is also attenuated 25 dB by R55 and R54 before reaching the front panel.

PIN DRIVER ④

Pin Driver Board (A12)

The PIN Driver circuit (A12) is controlled by the 1450-1 agc circuit, and sets the currents that drive the RF PIN Attenuator (A2). (See Fig. 3-7.) The board input is a 5-bit parallel binary signal. Three Programmable Read Only Memories (PROM) transform the 5-bit input code into two 12-bit parallel binary signals that switch two sets of binary-weighted current sources. The current sources drive the series and shunt diodes in the RF PIN Attenuator (A2).

The desired effect is to have the RF PIN Attenuator (A2) change its attenuation in equal steps when required by the 1450-1 agc. Nonlinearity of the PIN diodes is compensated for by programming the PROM outputs to switch the correct amount of current from the current sources to the attenuator. This results in 32 levels of attenuation that are separated by 0.7 dB each, for a total of 21.7 dB of agc range in the down converter. To achieve this accuracy, the PROM must be specially programmed for the individual PIN diode characteristics. This is done by inserting a PROM simulator into the PROM sockets, determining the correct program for each step, and programming the PROM. To maintain the accuracy should a PIN diode or PROM fail, we recommend that the down converter be returned to Tektronix for repair and recalibration of this circuit. (See the Maintenance section of this manual for further information).

PROM

The PIN Driver PROM (U44, U64, and U14) each have 256 memory locations. Each memory location may be programmed as a binary "1" or "0". The memory is formatted in 32 words (or bytes) of 8 bits of memory each. The 5-bit input to the board is fed to address lines A0 through A4 of each PROM. All combinations of the input signal (2 to the 5th power) account for the 32 input address locations.

U64's memory is shared between U44 and U14 to get the 12-bit binary output required to drive the current sources. The shunt memory output consists of U44 B0 through B7, and U64 B0 through B3. The series memory output consists of U64 B4 through B7, and U14 B0 through B7. This gives a possible 4096 (2 to the 12th power) output codes to choose from in programming the PROM to drive each of the current sources.

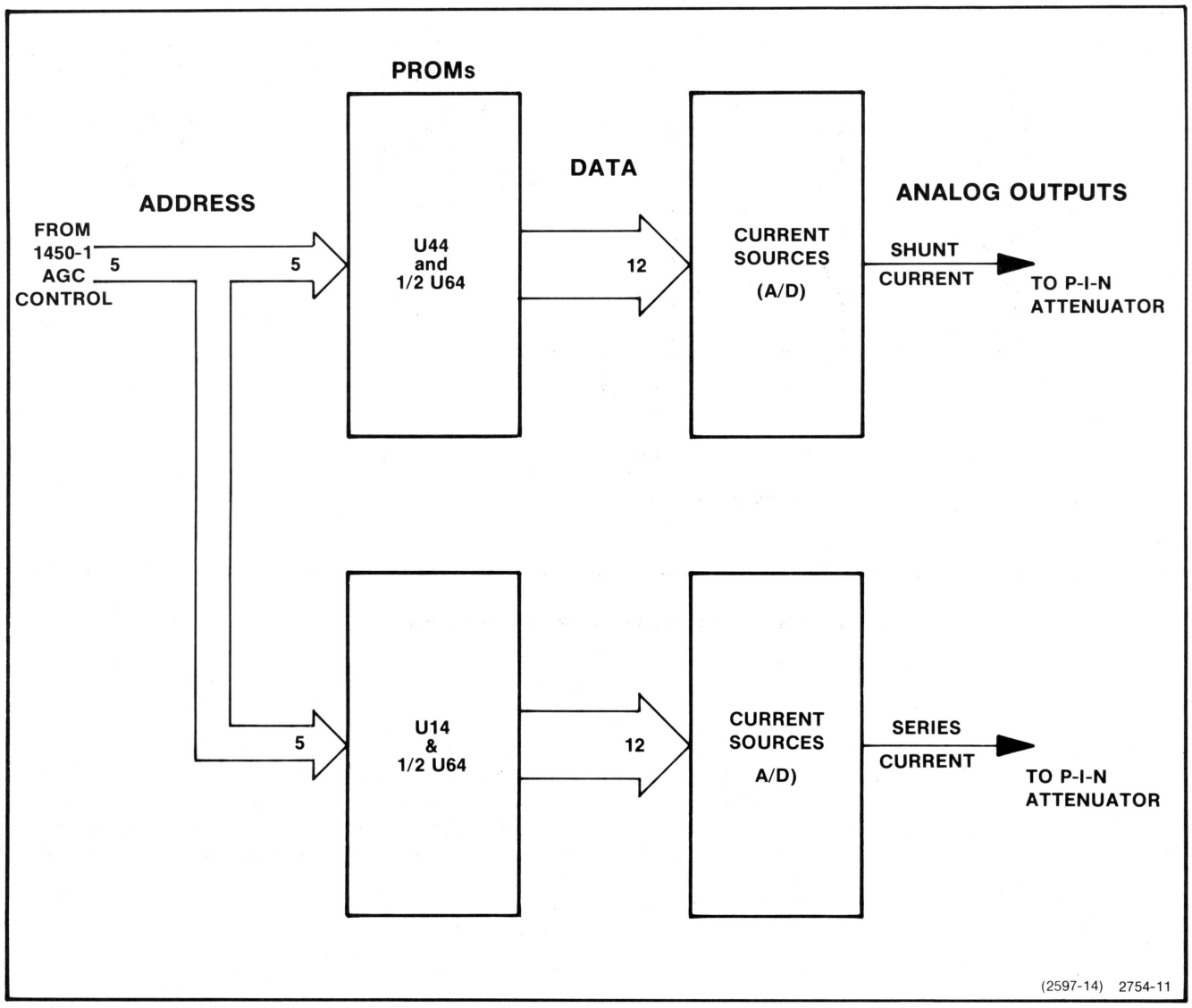


Fig. 3-7. PIN driver block diagram.

Current Sources (See Fig. 3-8.)

There are two sets of current sources. They provide shunt and series currents for the RF PIN Attenuator (A2). The shunt sources are the upper row of transistors and resistors shown in the schematic. The series sources are shown in the lower row.

Resistors R93 and R92 form a voltage divider at the base of Q81. Q81 provides a temperature compensation, and sets the level at the bases of all the current-source transistors. When a current source is switched on, its emitter voltage is the same as that at the base of Q81. This makes the current through the transistors dependent upon the value of the emitter resistors. The collectors of each set of current source transistors are connected together, thus summing the currents at the outputs. The series-current output is P08-D, and the shunt-current output is at P08-C.

The current sources are binary weighted. The smallest current available is from Q19 in the shunt circuit, and Q80 in the series circuit. This can be considered as a reference current (Ir) for this description. The smallest current source then supplies Ir x 1. The next large current source supplies Ir x 2, the next Ir x 4, and so on. This progression of powers of 2 continues for the twelve current sources, so that the largest current available from a single source is Ir x 2048. If all current sources in one set were on at once, the total current available would be Ir x 4095. Therefore, there are 4096 possible currents to choose from to drive the PIN Attenuator.

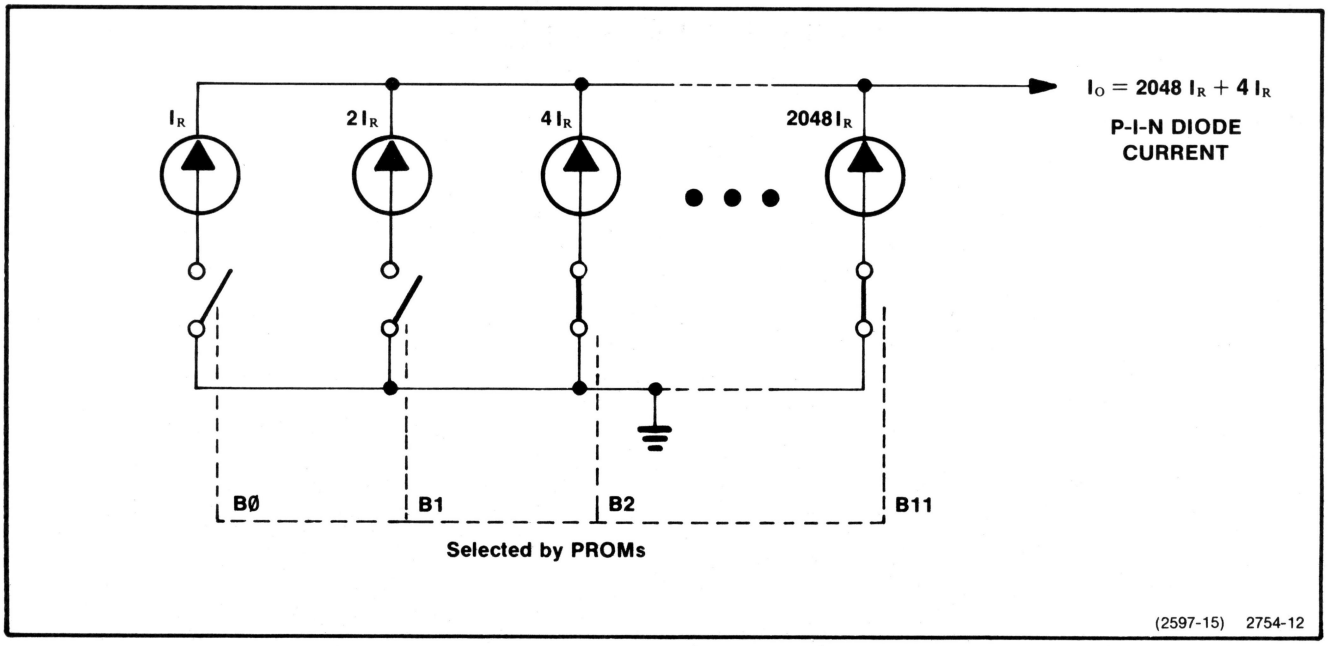


Fig. 3-8. Simplified diagram of pin attenuator current sources.

The current sources are switched on when the corresponding PROM outputs are high. The high-current sources, Q88 and Q10, are switched by transistors Q89 and Q00 respectively. When the PROM MSB (most Significant Bit) is high, the current through the emitter resistor passes through the current source transistor to the output. When the MSB is low, the source transistor is turned off, and the current is shunted by the switching transistor. This keeps a large amount of current from sinking in the PROM if all outputs should be low. The smaller value current sources are switched by diodes connected between the PROM and the current-source emitters.

CALIBRATION

Introduction

The procedures in this section serve as guides to perform the calibration steps necessary to ensure proper operation of the TDC1/TDC2. Limits, tolerances, and waveforms appearing in this section are not instrument specifications except as listed in Section 1, Specification.

The Calibration section consists of two separate procedures; the Performance Check Procedure and the Adjustment Procedure. The Performance Check Procedure verifies the instrument specifications, while the Adjustment Procedure ensures that the instrument will meet all performance requirements.

The TDC1/TDC2 front-panel names in the text are capitalized; e.g., RF IN. Control and connector names on test equipment and internal controls in the TDC1/TDC2 have only the first letter capitalized; e.g., Time/Div.

The capabilities of the test equipment listed are the minimum required to calibrate the TDC1/TDC2. If alternative equipment is used, it must meet or exceed the specifications of the listed equipment.

Refer to Table 4-1 for test equipment required for performance checks and calibration.

Refer to Table 4-2 for channel frequencies and other associated frequencies.

Table 4-1

TEST EQUIPMENT REQUIRED

Description	Minimum Specification	Use	Equipment Used
TEKTRONIX 1450-1 Television Demodulator	Same **if** as TDC1 and TDC2	System Checks	1450-1 Television Demodulator
VSWR Bridge (2 each)	10 MHz to 1 GHz and 40 dB Directivity	Return Loss Check/Adjustment and as Directional Coupler	Wiltron Model 62N50
Oscilloscope	Wide Band, At least 100 MHz	Performance Check and Adjustment	TEKTRONIX 7704 Oscilloscope
Oscilloscope Vertical Plug-in	At least 50 μV/div Sensitivity	System Frequency Response	TEKTRONIX 7A22
Oscilloscope Time Base Plug-in	5 ns/div to 5 s/div Calibrated Time Base	Performance Check and Adjustment	TEKTRONIX 7B53A
Spectrum Analyzer	At least 300 kHz and 3 MHz Resolutions	Performance Check and Adjustment	TEKTRONIX 7L13
Tracking Generator	Compatible with the Spectrum Analyzer	Performance Check and Adjustment	TEKTRONIX TR 502
RF Signal Generator (2 each)	Low Phase Noise and Stability in the order of 10 ppm/10 min	Performance Check and Adjustment	HP 8640B
RF Signal Generator	Low Phase Noise and Stability in the order of 10 ppm/10 min	Performance Check and Adjustment	HP 8614A
RF Signal Generator (2 each)	2nd Harmonic at least 25 dB down	Adjacent Channel Cross-modulation	TEKTRONIX SG 503 or SG 504
Multimeter		Adjustment Procedure	TEKTRONIX DM 502
Power Meter	Range from −25 dBm to +20 dBm	Setting Power Levels	HP 435A
Waveform Monitor	Field Rate and Line Rate Display	System Frequency Response and Noise Figure	TEKTRONIX 1480
Sweep Generator	100 kHz to 6 MHz Sweep Composite Video	System Frequency Response	TEKTRONIX TSG6 and SPG1/2 in 1410 Mainframe

Table 4-1 (cont)

Description	Minimum Specification	Use	Equipment Used
Frequency Counter	Compatible with TR 502	Performance Check and Adjustment	TEKTRONIX DC 508 Option 07
Power Supply Module	Drive several loads simultaneously	Performance Check and Adjustment	TEKTRONIX TM 503 Option 07
50 Ω Variable Attenuator	Must have Units and Tens steps	Bandpass Flatness and Variation in System Frequency Response	TEKTRONIX 2701
Test Modulator[a]	0.1 dB Flatness within channel limits and phase noise less than 0.2° rms. Signal Generator to drive Test Modulator 100 MHz to 1000 MHz with typical sideband phase noise of at least −70 dBc[a] at 100 Hz from the carrier as measured in a 1 Hz bandwidth.	Performance Check and Adjustment	Tektronix Part Number 067-0886-00 When available
Low Pass Filter	5.0 MHz	System Noise Figure	Tektronix Part Number 015-0213-00
2X Attenuator	50 Ω	Performance Check and Adjustment	Tektronix Part Number 011-0069-01
Male N-to-Female BNC Adapter (6 each)		Performance Check and Adjustment	Tektronix Part Number 103-0045-00
Female N-to-Male BNC Adapter (2 each)		Performance Check and Adjustment	Tektronix Part Number 103-0058-00
Male SMA-to-Female BNC Adapter (4 each)		Performance Check and Adjustment	Tektronix Part Number 015-1018-00
BNC-to-Conhex Adapter Cable (2 each)		Adjustment Procedure	Tektronix Part Number 175-2412-00
Male BNC-to-Pin Jack Adapter Cable		Performance Check and Adjustment	Tektronix Part Number 175-1178-00
Female-to-Female Conhex Adapter (2 each)		Adjustment Procedure	Tektronix Part Number 103-0098-00
10" Long Cable (2 each)	50 Ω	Performance Check and Adjustment	Tektronix Part Number 012-0208-00
20" Long Cable (2 each)	50 Ω	Performance Check and Adjustment	Tektronix Part Number 012-0076-00
43" Long Cable (4 each)	50 Ω	Performance Check and Adjustment	Tektronix Part Number 012-0057-00
Frequency Doubler	To be used in TDC2 Performance Checks	Performance Check	HP 10515A

[a] dBc = dB referenced to carrier.

Optional Test Equipment

1. TDC1/TDC2 Extender Fixture, Tektronix Part Number 067-0899-00
2. Torx Screwdriver, Tektronix Part Number 003-0816-00
3. Plug Driver, Tektronix Part Number 003-0842-00
4. Modified Wrench, Tektronix Part Number 003-0843-00
5. 5/64" Allen Wrench
6. 0.05" Allen Wrench
7. Small Slotted Screwdriver
8. Low Capacitance Adjustment Tool
9. Grease Pen

Table 4-2

FREQUENCIES ASSOCIATED WITH TELEVISION CHANNELS IN THE U.S. AND CANADA

CHANNEL FREQUENCIES

Channel	Limits	Visual	1st LO
2	54-60	55.25	492
3	60-66	61.25	498
4	66-72	67.25	504
5	76-82	77.25	514
6	82-88	83.25	520
A	120-126	121.25	558
B	126-132	127.25	564
C	132-138	133.25	570
D	138-144	139.25	576
E	144-150	145.25	582
F	150-156	151.25	588
G	156-162	157.25	594
H	162-168	163.25	600
I	168-174	169-25	606
7	174-180	175.25	612
8	180-186	181.25	618
9	186-192	187.25	624
10	192-198	193.25	630
11	189-204	199.25	636
12	204-210	205.25	642
13	210-216	211.25	648

Table 4-2 (cont)

CHANNEL FREQUENCIES

Channel	Limits	Visual	1st LO
J	216-222	217.25	654
K	222-228	223.25	660
L	228-234	229.25	666
M	234-240	235.25	672
N	240-246	241.25	678
O	246-252	247-25	684
P	252-258	253.25	690
Q	258-264	259.25	696
R	264-270	265.25	702
S	270-276	271.25	708
T	276-282	277.25	714
U	282-288	283.25	720
V	288-294	289.25	726
W	294-300	295.25	732
14	470-476	471.25	912
15	476-482	477.25	918
16	482-488	483.25	924
17	488-494	489.25	930
18	494-500	495.25	936
19	500-506	501.25	942
20	506-512	507.25	948
21	512-518	513.25	954
22	518-524	519.25	960
23	524-530	525.25	966

Table 4-2 (cont)

CHANNEL FREQUENCIES

Channel	Limits	Visual	1st LO
24	530-536	531.25	972
25	536-542	537.25	978
26	542-548	543.25	984
27	548-554	549.25	990
28	554-560	555.25	996
29	560-566	561.25	1002
30	566-572	567.25	1008
31	572-578	573.25	1014
32	578-584	579.25	1020
33	584-590	585.25	1026
34	590-596	591.25	1032
35	596-602	597.25	1038
36	602-608	603.25	1044
37	608-614	609.25	1050
38	614-620	615.25	1056
39	620-626	621.25	1062
40	626-632	627.25	1068
41	632-638	633.25	1074
42	638-644	639.25	1080
43	644-650	645.25	1086
44	650-656	651.25	1092
45	656-662	657.25	1098
46	662-668	663.25	1104
47	668-674	669.25	1110
48	674-680	675.25	1116
49	680-686	681.25	1122
50	686-692	687.25	1128
51	692-698	693.25	1134
52	698-704	699.25	1140
53	704-710	705.25	1146
54	710-716	711.25	1152
55	716-722	717.25	1158
56	722-728	723.25	1164
57	728-734	729.25	1170
58	734-740	735.25	1176
59	740-746	741.25	1182
60	746-752	747.25	1188
61	752-758	753.25	1194
62	758-764	759.25	1200
63	764-770	765.25	1206
64	770-776	771.25	1212
65	776-782	777.25	1218
66	782-788	783.25	1224
67	788-794	789.25	1230
68	794-800	795.25	1236
69	800-806	801.25	1242
70	806-812	807.25	1248
71	812-818	813.25	1254
72	818-824	819.25	1260
73	824-830	825.25	1266
74	830-836	831.25	1272

Table 4-2 (cont)

CHANNEL FREQUENCIES

Channel	Limits	Visual	1st LO
75	836-842	837.25	1278
76	842-848	843.25	1284
77	848-854	849.25	1290
78	854-860	855.25	1296
79	860-866	861.25	1302
80	866-872	867.25	1308
81	872-878	873.25	1314
82	878-884	879.25	1320
83	884-890	885.25	1326

NOTE

Image Aural Carrier Frequency = 2 (Aural IF) + Aural RF
Image Visual Carrier Frequency = 2(Visual 1st IF) + Visual RF
1st LO Frequency = Visual Carrier Frequency + Visual 1st IF Frequency
2nd LO = 1st IF − 2nd IF (IF OUT)
= 399.75 MHz for Option 1 VHF
= 397.85 MHz for Option 2 VHF
= 391.0 MHz for Option 3 VHF
= 403.75 MHz for Option 1 UHF
= 401.85 MHz for Option 2 UHF
= 395.0 MHz for Option 3 UHF

The IF OUT signal on the down converter front panel is the instrument "2nd IF". It has a frequency bandpass orientation that is inverted from the **rf** bandpass. That is, the **if** visual carrier frequency is above the **if** aural carrier frequency. Thus for Option 3, (**if** Visual carrier frequency = 45.75 MHz) the **if** aural carrier frequency is 41.25 MHz.

PERFORMANCE CHECK AIDS

Short-Form Performance Check Aids

1. Calibrating The 1450-1 Readout 4-5
2. Measuring Frequency 4-6
3. Setting Up 0.2 dB/Div Reference Flatness . . . 4-6

The Spectrum Analyzer (7L13) must be checked for calibration before any measurements are made. Refer to the 7L13 Instruction Manual.

Check the directivity of the Vswr Bridge (at least 40 dB) before making any measurements.

The 1450-1 front panel settings are as follows, except where otherwise noted:

Detection Mode	Synchronous (Cont)
Sound Trap	In
Internal Zero Carrier Ref	Off
Auto AGC	Sync Tip
Synchronous Time Constant	Norm
10 dB and 20 dB Buttons	Out

The 1450-1 readout is calibrated to operate with a fixed channel down converter (4.7 dB offset). If a tunable down converter is to be installed in a 1450-1 to complete a SYSTEM, the 1450-1 must be reset to operate with the tunable down converter. Hence, the Readout Driver board, (A61) in the 1450-1, should be checked for correct settings of S56 and S57 (Readout Counter Presets—tenths and ones) before an TDC1 or TDC2 performance parameters are checked.

1. Calibrating The 1450-1 Readout

The tunable down converters (TDC1 and TDC2) have an insertion gain of 1 dB, while the fixed channel down converter (TDC) has an insertion gain of 4.7 dB. The difference in gain between the two instruments is 3.7 dB.

Refer to Fig. 4-1. S56 and S57 settings on the Readout Driver board on A61 should match Fig. 4-1. This compensates for insertion gain differences between the fixed channel down converter and the tunable down converter.

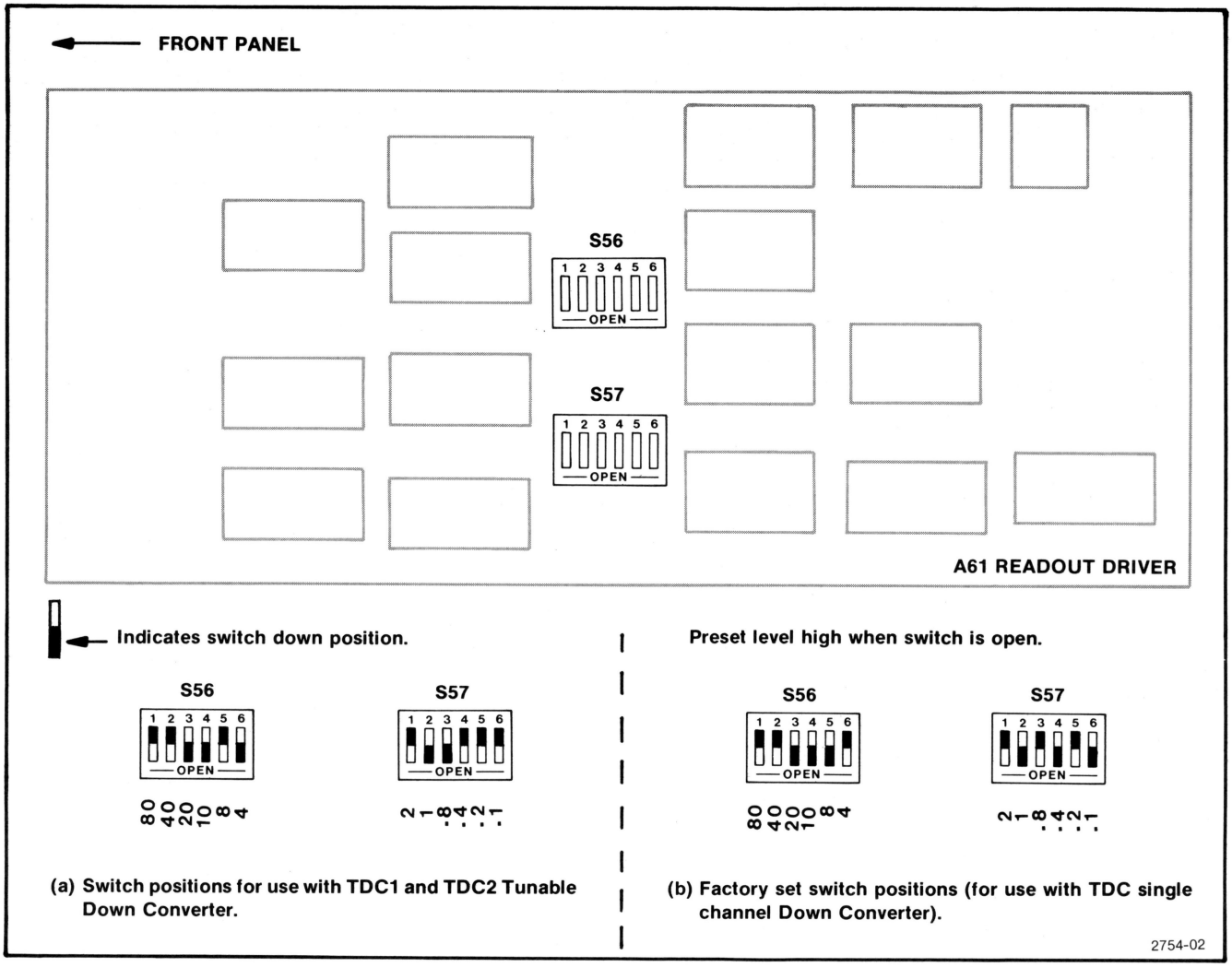


Fig. 4-1. Calibrating the 1450-1 Readout.

2. Measuring Frequency

The Option 07 feature in the TEKTRONIX DC 508 frequency Counter and TM 503 Power Moudle in conjunction with the 7L13 Spectrum Analyzer, can be used to make accurate frequency measurements.

a. Using the cables supplied with the accessories, connect the TR 502 Tracking Generator 1st and 2nd LO outputs to the 7L13 1st and 2nd LO inputs. Connect the spectrum-analyzer Tracking Generator Logic output to the TR 502 Tracking Generator input. Fig. 4-2 illustrates the test equipment setup.

b. Connect the TF 502 Aux RF to the DC 508 input. An sma-to-bnc adapter is required to complete the connection to the TR 502 Aux RF output connector. Set the TR 502 Dot Intensity control out of detent.

NOTE

The TR 502 features a sweep-stop operational mode that stops the sweep at the center of the screen, and instructs the frequency counter to take a frequency measurement, then allows the sweep to continue. When the analyzer is phase-locked, the accuracy of the count is to the nearest 10 Hz; when the analyzer is not phase-locked, the accuracy is to the nearest 100 kHz. This sweep-stop mode can be turned off by the Dot Intensity control on the TR 502 front panel. Thus, when the 7L13 Center Frequency control is set such that the signal is centered about the intensified dot on the analyzer display, the DC 508 counter reads the frequency accurately.

3. Setting Up 0.2 dB/Div Reference Flatness

Some checks and adjustments performed using a spectrum analyzer have tolerances of 1 dB or less. Therefore, the test oscilloscope must be calibrated for 0.2 dB/Div in order to perform these checks and adjustments. Performing the following steps will suffice.

a. Connect the test equipment as shown in Fig. 4-3. Make the appropriate connections between the tracking generator and the spectrum analyzer (1st LO, 2nd LO, and Track Gen (Logic)).

b. Set the spectrum analyzer Reference Level to locate the power level set with the tracking generator Output

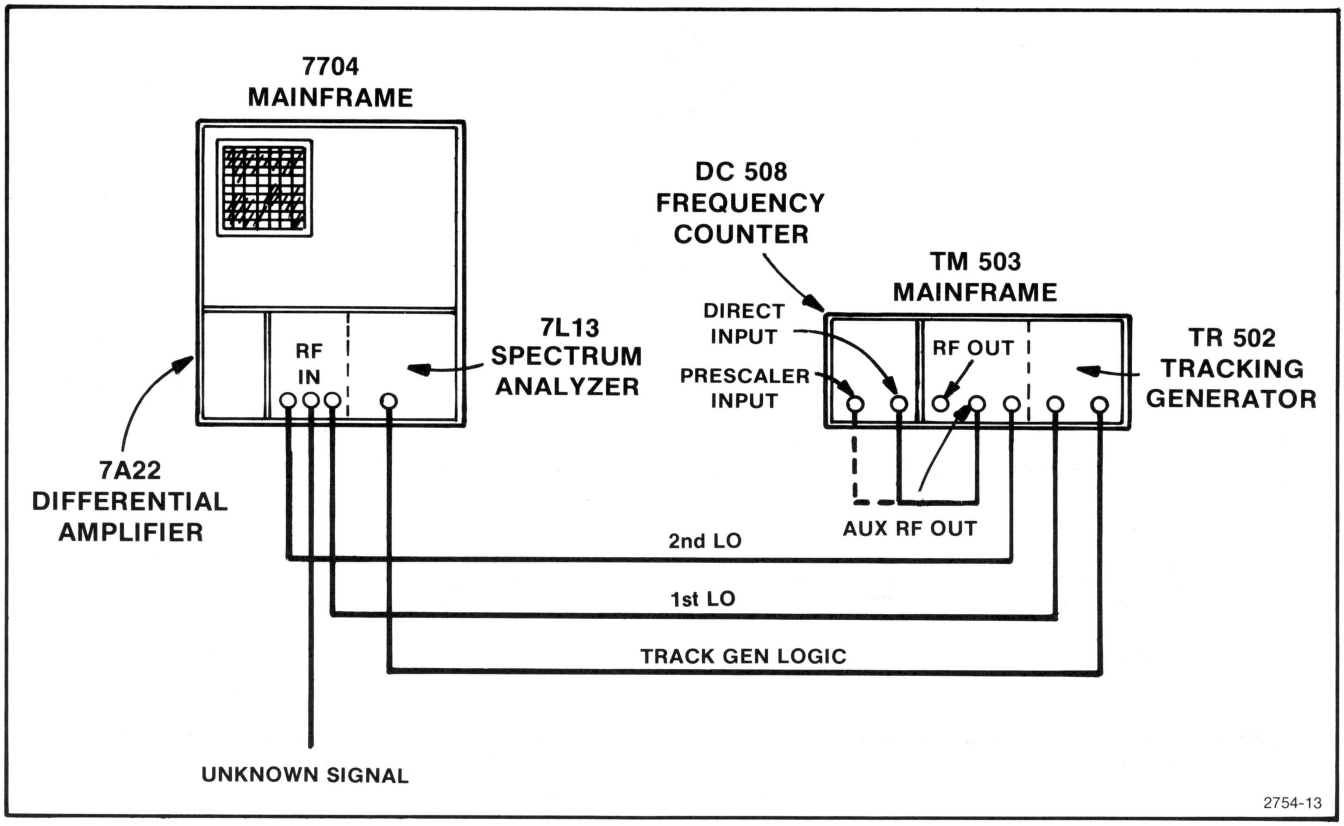


Fig. 4-2. Test Setup for Measuring Frequency Using the Spectrum Analyzer/Tracking Generator/DC 508 Option 07.

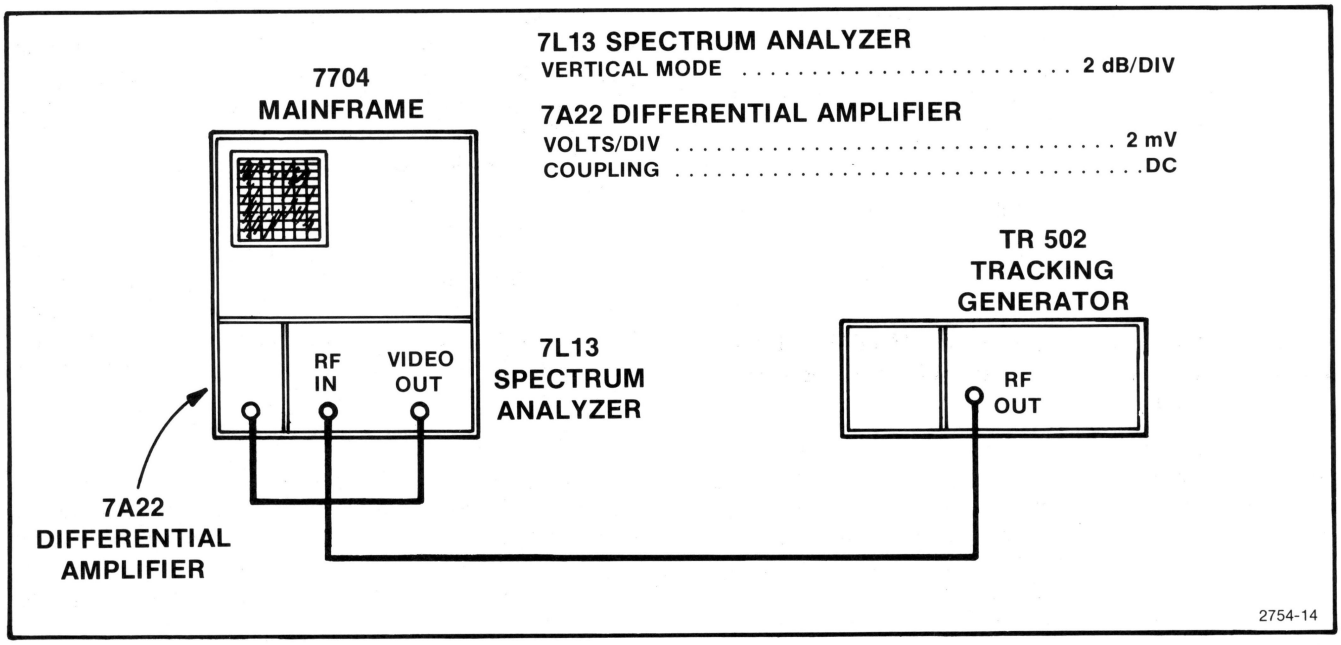


Fig. 4-3. Setting up 0.2 dB Reference Flatness.

Level control, then push in the test oscilloscope mainframe Left Vertical Mode button.

c. Use the differential amplifier DC Offset control to bring the trace within the viewing area.

d. Use the Variable Volts/Div control on the differential amplifier to set up a 5-division excursion of the trace as 1 dB of attenuation is added and removed from the tracking generator signal.

e. The test oscilloscope is now calibrated for 0.2div. A grease pen may be used to mark the trace on the implosion shield or graticule. This will be the reference flatness at 0.2 dB/Div.

PERFORMANCE CHECK

Short-Form Performance Check

1. Check Down Converter and SYSTEM Return Loss (10 dB Down Converter Only) (30 dB With 20 dB Attenuation or Greater) 4-8
2. Check Input Frequency Range (±20 kHz) . . . 4-9
3. Check RF Input Power Level Range and IF OU Level (Input: −66 dBm to 0 dBm) (IF OUT: −64 dBm to −20 dBm max) 4-9
4. Check 1st IF Image Rejection Ratio (50 dB or Greater VHF) (40 dB or Greater UHF) 4-10
5. Check 2nd IF Image Rejection Ratio (60 dB or Greater) 4-10
6. Check 1st IF Rejection Ratio (VHF 50 dB or Greater) (UHF 30 dB or Greater) 4-10
7. Check Visual IF Frequency (Specified IF ±120 kHz) 4-11
8. Check 1st LO Output Frequency (VHF = 436.75 MHz + Visual Carrier ±90 kHz) (UHF = 440.75 MHz + Visual Carrier ±90 kHz) 4-11
9. Check 2nd LO OUTput Frequency and Level (VHF Option 1 = 399.75 MHz ±10 kHz) (VHF Option 2 = 397.85 MHz ±10 kHz) (VHF Option 3 = 391.0 MHz ±10 kHz) (UHF Option 1 = 403.75 MHz ±10 kHz) (UHF Option 2 = 401.85 MHz ±10 kHz) (UHF Option 3 = 395.0 MHz ±10 kHz) 4-12
10. Check Down Converter AGC Range (21.7 dB) 4-12
11. Check 3rd Order Input Intercept Point (+5 dBm)4-13
12. Check Variation in Frequency Response As a Function of AGC (±0.25 dB) 4-14
13. Check SYSTEM Signal to Noise Ratio and Noise Figure (S/N = 58 dB or Better) (Noise Figure = 19 dB or Less) 4-15
14. Check Low Frequency Phase Noise (0.5 Degrees rms or Less) 4-16
15. Check SYSTEM AGC Range (66 dB) 4-16
16. Check SYSTEM Adjacent Channel and 2nd Adjacent Channel Cross-modulation (60 dB) . 4-17

17. Check SYSTEM Chrominance Carrier/Aural Carrier/Visual Carrier Intermodulation (50 dB) 4-17

18. Check Variation in System Frequency Response (±0.3 dB or Less) 4-19

19. Check Readout Accuracy (±2 dB) 4-20

20. Check Readout Resolution (±0.1 dB) 4-20

1. Check Down Converter and SYSTEM Return Loss (10 dB Down Converter Only) (30 dB with 20 dB Attenuator)

a. Connect the 1450-1 Television Demodulator and test equipment as shown in Fig. 4-4. Install the TDC1 or TDC2 Television Down Converter to be tested in the 1450-1 and make the appropriate front-panel connections. Set the TR 502 Output Level at −20 dBm. Disconnect the Vswr Bridge from the 1450-1, and note the level on the spectrum analyzer. This level will be used as a reference level for measuring return loss. Connect the Vswr Bridge to a reference 50 Ω load and check that the return loss read is at least 35 dB. Disconnect the 50 Ω load from the Vswr Bridge and connect the bridge to the down converter RF INput.

b. Tune the down converter to channel 2 if testing a TDC1 or channel 14 if testing a TDC2. Set the spectrum analyzer Center Frequency control for the down converter center frequency (that is 3 MHz up from the channel lower limit or 3 MHz down from the channel upper limit), and Freq Span/Div at 2 MHz. See Table 4-2 for channel frequency limits.

c. Check that return loss is at least 10 dB down from the reference level. Check return loss for every channel in the down converter. That is, (1) tune the down converter to the next channel, (2) reset the spectrum analyzer to the center frequency of the tuned channel, and (3) check return loss.

d. Disconnect the bridge from the down converter RF INput, and connect it to the SYSTEM RF Input at the rear panel of the 1450-1. Be sure to connect the 1450-1 RF output to the down converter RF IN on the front panel. Be sure that the 1450-1 10 dB and 20 dB buttons are not pushed in.

e. Check that return loss is at least 10 dB down from the reference level. Again check return loss for every channel in the down converter.

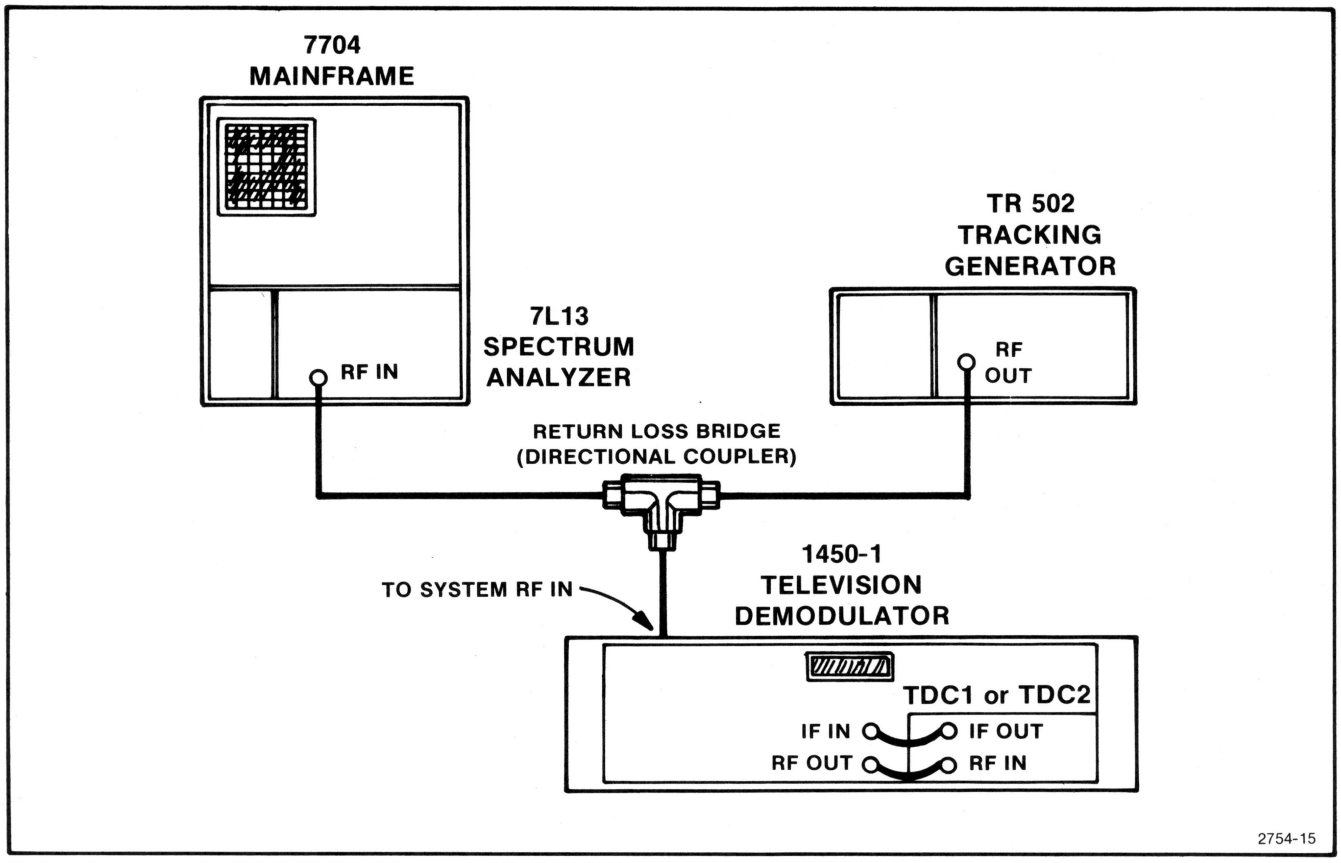


Fig. 4-4. Test Setup for Measuring Return Loss.

f. Push in the 20-dB Attenuator button on the 1450-1 front panel.

g. Check that return loss is at least 30 dB down from the reference level.

h. Push in the 10 dB and 20 dB buttons on the 1450-1 front panel.

i. Check that return loss is at least 30 dB down from the reference level.

2. Check Input Frequency Range (±20 kHz)

a. Connect a generator, such as an HP 8640B, **rf** output to the 1450-1 RF In as shown in Fig. 4-5.

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

b. Tune the down converter to a specific channel, and check to see that the phase-lock LEDs are off.

c. Set the HP 8640B frequency to the visual carrier frequency of the down converter under test. Refer to Table 4-2 for visual carrier frequencies. Check to see that the 1450-1 Unlocked light is off.

d. Disconnect the cable from the down converter IF OUT connector, and connect the down converter IF OUTput to a spectrum analyzer. Set the spectrum analyzer Center Frequency to the **if** of the down converter.

e. Check that the IF OUT frequency remains within 120 kHz of the specified **if** as the HP 8640B is varied 20 kHz above and below the visual carrier frequency.

3. Check RF Input Power Level Range and IF OUT Level (Input: −65 dBm to +1 dBm) (IF OUT: −64 dBm to −20 dBm max)

a. In this step, use a power meter to set the output level on the signal generator each time the level is changed. Make the check at the lowest and highest number channel of the down converter.

NOTE

Replace the HP 8640B with a TEKTRONIX SG 504 when checking TDC2 channels 26 through 83.

b. Drive the down converter RF IN with an HP 8640B Signal Generator, and tune the down converter to a specific channel. Set the HP 8640B frequency at the visual carrier frequency of the down converter, and set the Output Level at +1 dBm. See Table 4-2 for carrier frequencies. Push the Manual Gain button on the 1450-1 front panel and set the Manual Gain control for a +1 dBm indicated input level. Monitor the down converter IF OUT with a spectrum analyzer, and set the spectrum analyzer Center Frequency for the visual **if** frequency of the down converter under test.

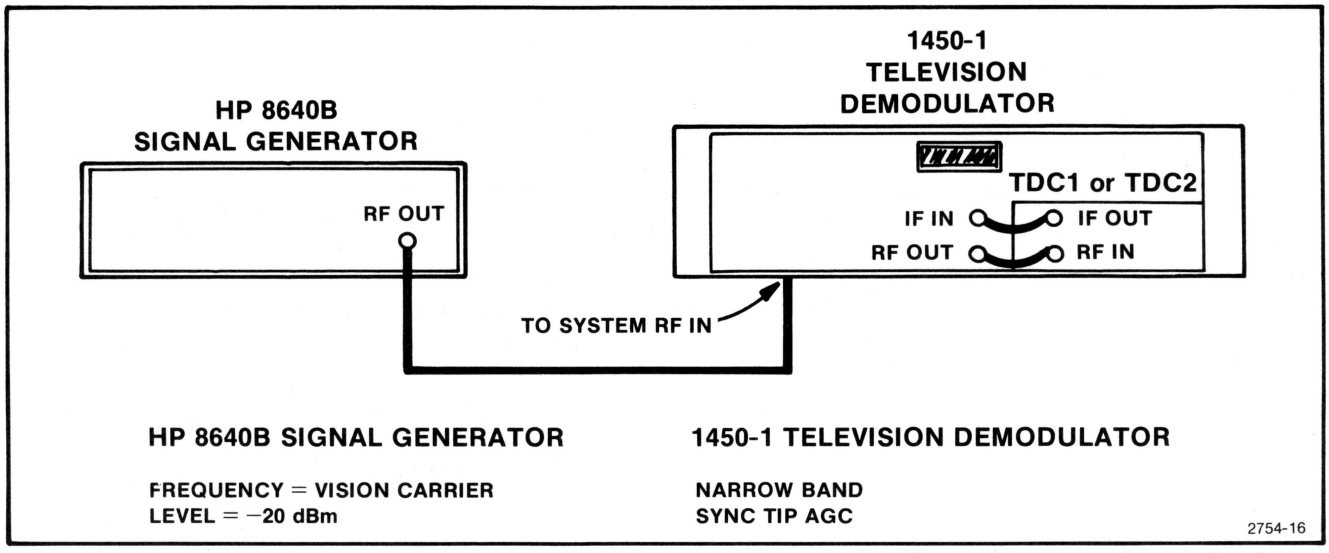


Fig. 4-5. Test Setup for Measuring Input Frequency Range.

c. Check that the IF OUT is −20 dBm ±1 dB.

d. Change the HP 8640B Output Level to −21 dBm and reset the 1450-1 Manual Gain to indicate a −21 dBm input level.

e. Check that the IF OUT is −20 dBm ±1 dB.

4. Check 1st IF Image Rejection Ratio (50 dB or greater vhf) (40 dB or greater uhf)

a. Tune the down converter to the lowest number channel (down converter phase-locked).

b. Drive the down converter RF Input with a signal generator (such as an HP 8640B or an HP 8620B/HP 8622A combination, depending on the down converter being checked). Set the signal generator output frequency at (2 X 1st IF + Visual Carrier Frequency), and output level at −21 dBm.

NOTE

The SG 504 is to be used to check the TDC1, and the HP 8614 is to be used to check the TDC2.

TDC1 Visual Carrier 1st IF = 436.75 MHz
TDC2 Visual Carrier 1st IF = 440.75 MHz

EXAMPLES

(1) TDC1 tuned to channel 2, signal generator set at (2 X 436.75 MHz + 55.25 MHz) or 928.75 MHz.

(2) TDC2 tuned to channel 14, signal generator set at (2 X 440.75 MHz + 471.25 MHz) or 1352.75 MHz.

c. Monitor the down converter IF OUTput with a spectrum analyzer such as a TEKTRONIX 7L13. Set the spectrum analyzer front panel to view the front-panel IF OUT visual carrier.

d. Push in the 1450-1 Man button, and set the Manual Gain control for −21 dBm indicated input signal.

e. Check that the IF OUT signal is at least −70 dBm if checking a TDC1, or −60 dBm if checking a TDC2 (at least 50 dB down from the −20 dBm normal IF OUTput level for this input level when checking a TDC1 or 40 dB down when checking a TDC2).

5. Check 2nd IF Image Rejection Ratio (60 dB or greater)

a. Tune the down converter to a specific channel (down converter phase-locked).

b. Drive the down converter RF INput with a signal generator such as an HP 8640B. Set the signal generator output frequency at (2 X Visual Carrier IF OUT − 4.5 MHz + visual carrier frequency), and output level at −21 dBm.

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

EXAMPLE

TDC1 Tuned to Channel 6 (IF OUT = 45.75 MHz)

Generator set at:

(2 X 45.75 MHz) − 4.5 MHz + 83.25 MHz which equals to 170.25 MHz.

c. Monitor the down converter IF OUTput with a spectrum analyzer such as a TEKTRONIX 7L13. Set the spectrum analyzer front panel to view the 2nd IF OUT aural carrier frequency. See the following table:

2nd IF Image

Option	Visual Carrier IF OUT	Aural Carrier IF OUT
1	37 MHz	32.5 MHz
2	38.9 MHz	34.4 MHz
3	45.75 MHz	41.25 MHz

d. Push in the 1450-1 Man button, and set the Manual Gain control for −21 dBm indicated input signal.

e. Check that the 2nd IF image signal is −80 dBm or less.

6. Check 1st IF Rejection Ratio (vhf 50 dBm or greater) (uhf 30 dB or greater)

a. Tune the down converter to channel W if checking TDC1 or channel 14 if checking TDC2. Monitor the IF OUTput with a spectrum analyzer such as a TEKTRONIX 7L13. Set the spectrum analyzer front panel to view a −20 dBm signal at the if frequency of the down converter.

b. Push in the 1450-1 Sync Tip (Auto AGC) button.

c. Drive the down converter with a signal generator such as an HP 8640B. Set the generator frequency at the **rf** visual carrier frequency of the down converter under test, and output level at −21 dBm.

d. Note the spectrum analyzer display amplitude (about −20 dBm at the **if** frequency of the down converter under test). This will be the reference level. Reset the signal generator output frequency to the 1st IF visual carrier frequency of the down converter (output level still at −21 dBm).

NOTE

TDC1 ist IF Frequency = 436.75 MHz
TDC2 1st IF Frequency = 440.75 MHz

e. Check that the IF OUTput as displayed on the spectrum analyzer is at least 50 dBm down from the reference established in part d if testing the TDC1. Check that the IF OUTput is at least 30 dBm down from the reference established in part d if testing the TDC2.

7. Check Visual IF Frequency (specified if ±120 kHz)

a. Tune the down converter to a specific channel (down converter phase-locked). Drive the down converter RF INput with a cw signal generator such as an HP 8640B.

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

b. Set the HP 8640B frequency to the visual carrier frequency of the down converter under test and set the Output Level for −20 dBm. Connect the down converter IF OUT to the spectrum analyzer, and set the spectrum analyzer Center Frequency to the down converter **if** frequency.

c. Check that the output frequency is within 100 kHz of the exact visual **if** frequency. See Step 2 in the performance check aids preceding the performance check. This will allow the **rf** carrier to have up to a 20 kHz offset from the exact visual carrier frequency and still be within ±120 kHz tolerance.

8. Check 1st LO Output Frequency (vhf = 436.75 MHz + Visual Carrier) (uhf = 440.75 MHz + Visual Carrier)

a. Monitor the 1st LO OUT connector with a frequency counter such as a TEKTRONIX DC 508. If checking the TDC1, tune it to channel 2, and if checking the TDC2, tune it to channel 14.

NOTE

When the down converter is tuned to a channel (phase-locked), the 1st LO frequency is equal to the sum of the channel **rf** *visual carrier frequency and 436.75 MHz for the TDC1 or channel visual carrier and 440.75 MHz for the TDC2. Refer to Table 4-2 for 1st LO frequencies.*

b. Omit this part if checking a TDC2, and proceed to part f. Tune the TDC1 from channel 2 to channel 13 including the CATV channels A through W, and make a note of the frequency counter reading and the channel each time the down converter is phase-locked to a channel.

c. Check that the frequencies noted in part b are equal to the sum of the channel **rf** visual carrier frequency and 436.75 MHz ±90 kHz. See Table 4-2 for 1st LO frequencies.

d. Push in the PHASE LOCK LOOP switch on the down converter front panel, and tune the down converter to channel 2. Now tune the down converter from the lowest to the highest frequency on the tuning dial tape, and note that the spectrum analyzer shows a smooth tuning of the 1st LO with no discontinuous jumps. Also note the frequency reading changes on the frequency counter.

NOTE

1st LO OUTput power is nomially +10 dBm.

e. Check that the frequency counter/spectrum analyzer combination indicates frequencies from 492 MHz through 472 MHz. Also check that the 1st LO frequency changes as the tuning control is varied (down converter not phase-locked).

f. Omit parts f through i if checking a TDC1. Tune the TDC2 from channel 14 to channel 83, and make a note of the frequency counter reading and the channel each time the down converter is phase-locked to a channel.

NOTE

The DC 508 Frequency Counter measures frequencies up to 1 GHz as per specification. Therefore **lo**

frequencies for channels 29 through 83 cannot be measured with a DC 508.

An alternate method to measure frequencies beyond the DC 508 range is the use of a known signal source and a spectrum analyzer. This involves observing the 2nd harmonic of the known signal source with a spectrum analyzer.

EXAMPLE

Suppose you want to look at channel 83 **lo** *frequency. Note in Table 4-2 that the* **lo** *frequency for channel 83 is 1326 MHz. If this were the 2nd harmonic of a known signal source, the fundamental would be 663 MHz.*

Therefore, set the output frequency of the known signal source to 663 MHz as counted with a DC 508. Monitor the signal source with the spectrum analyzer set to view the 2nd harmonic (1362 MHz). Set the spectrum analyzer Freq Span/Div at 20 kHz. The location of the 2nd harmonic on the spectrum analyzer now becomes the reference.

Now tune the TDC2 to channel 83, and monitor the 1st LO OUTput with the spectrum analyzer. If the 1st LO in the down converter has been adjusted properly, it will coincide with the reference established on the spectrum analyzer.

g. Check that the frequencies noted in part d are equal to the sum of the channel **rf** visual carrier frequency and 440.75 MHz ±90 kHz. See Table 4-2 for 1st LO frequencies.

h. Push in the PHASE LOCK LOOP switch on the down converter front panel, and tune the down converter to channel 14. Now tune the down converter from the lowest to the highest frequency on the tuning dial tape, and note that the spectrum analyzer shows a smooth tuning of the 1st LO with no discontinuous jumps. Also note the frequency reading changes on the frequency counter.

i. Check that the frequency counter/spectrum analyzer combination indicates frequencies from 912 MHz through 1326 MHz. Also check that the 1st LO frequency changes as the tuning control is varied (down converter not phase-locked).

NOTE

The dial reading versus channel location is sensitive to the 2nd LO leaking from the front panel connector (LO OUT). This front-panel connector must be terminated in 50 Ω for correct tape alignment.

9. Check 2nd LO OUTput Frequency and Power Level (Vhf Option 1 = 399.75 MHz ±10 kHz) (Vhf Option 2 = 397.85 MHz ±10 kHz) (Vhf Option 3 = 391.0 MHz ±10 kHz) (Uhf Option 1 = 403.75 MHz ±10 kHz) (Uhf Option 2 = 401.85 MHz ±10 kHz) (Uhf Option 3 = 395.0 MHz ±10 kHz)

a. Monitor the 2nd LO OUTput with a frequency counter such as a TEKTRONIX DC 508.

b. Check that the frequency counter indicates the correct **lo** frequency ±10 kHz.

c. Monitor the 2nd LO OUTput with a spectrum analyzer set to view the 2nd LO frequency.

d. Check that the 2nd LO power level is −5 dBm ±2 dB (±5 dBm nominal).

10. Check Down Converter AGC Range (0 to 21.7 dB)

a. Install the down converter in the 1450-1 mainframe, and tune it to a specific channel. Connect the 1450-1 mainframe RF Output to the down converter RF INput using the cable provided.

b. Push in the 1450-1 Man button, and set the Manual Gain control fully counterclockwise.

c. Drive the SYSTEM RF Input with a cw signal generator, such as an HP 8640B. Set the generator output frequency at the SYSTEM visual carrier frequency, and output level at +0.7 dBm as seen on a power meter.

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

d. Monitor the down converter IF OUTput with a spectrum analyzer set to view the **if** signal at −20 dBm.

@

e. Check that the down converter IF OUTput is 20 dBm ±1 dB.

f. Reduce the generator output level to −21 dBm.

g. Setup the 0.2 dB reference. Refer to step 3 in the Performance Check Aids.

h. Slowly vary the 1450-1 Manual Gain control from fully counterclockwise to fully clockwise, and note 0.7 dB step changes of the IF OUTput signal.

i. Check that the IF OUTput signal changes in 0.7 dB steps.

j. Set the generator output level at −21.3 dBm, and set the 1450-1 Manual Gain control for a −21.3 dBm indicated **rf** input signal.

k. Check that the IF OUTput is −20 dBm ±1 dB.

11. Check 3rd Order Input Intercept Point (+5 dBm)

a. Connect the test equipment as shown in Fig. 4-6, and tune the down converter to a specific channel. Set the frequency of the generators 2 MHz apart at the center of the channel bandpass. For example, one generator would be set at 194 MHz and the second at 196 MHz for channel 10. See Table 4-2 for channel limits.

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

Replace the SG 503 with a TEKTRONIX SG 504 when checking TDC1 channels N through W and TDC 2 channels.

An alternate method for performing step 11 is to use a Tektronix SG 503 or SG 504 in place of the second HP 8640B signal generator in Fig. 4-6.

b. Set the output levels of the generators such that each of the signal levels are −20 dBm at the down converter **rf** input.

c. Push in the 1450-1 Man button, and set the Manual Gain control fully clockwise (maximum gain). Note that the IF OUTput has two signals 1 MHz apart at −20 dBm.

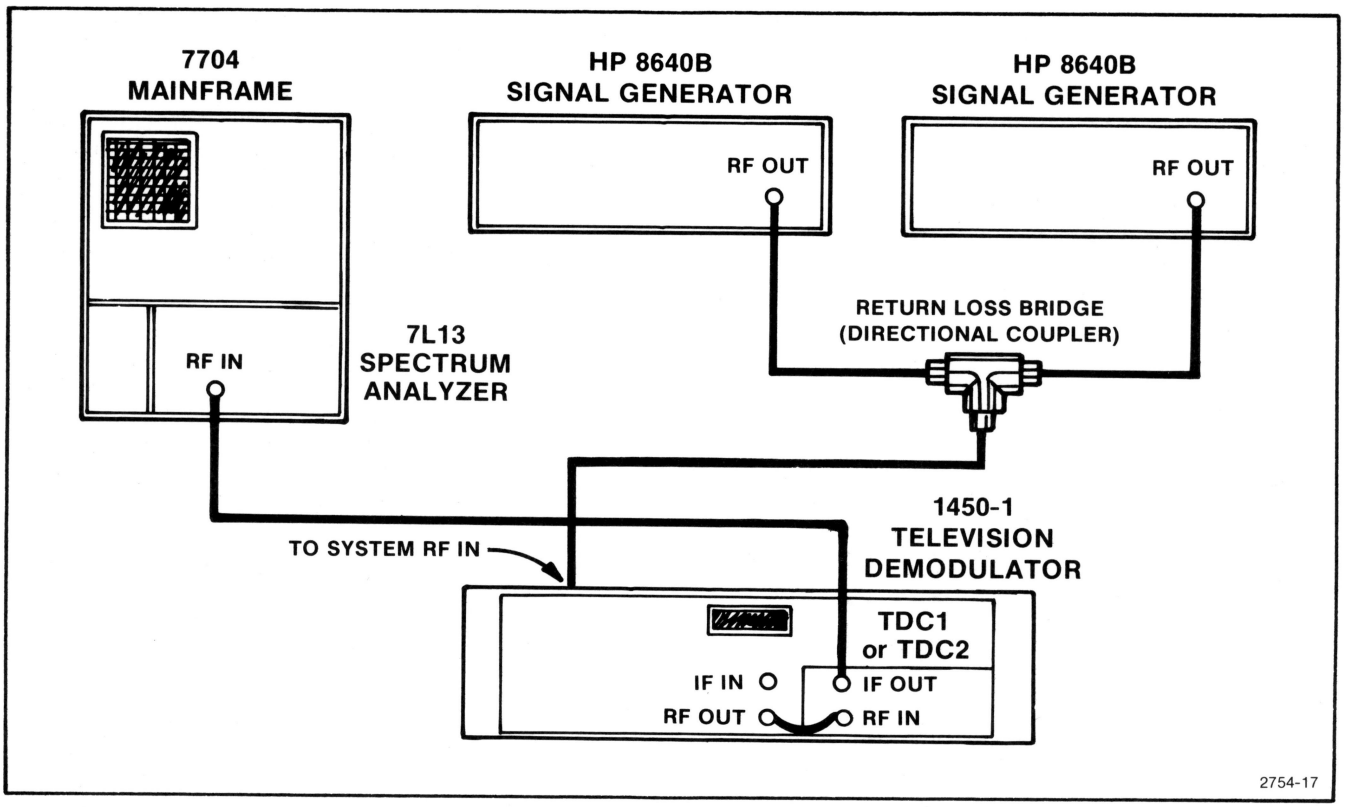


Fig. 4-6. Test Setup for Measuring 3rd Order Input Intercept Point.

d. Check that signals appearing 1 MHz above and below the −20 dBm signals are down −70 dBm or better.

12. Check Variation in Frequency Response as a Function of Agc (±0.25 dB)

a. Install the down converter in the 1450-1, and tune it to a specific channel.

b. Drive the down converter RF INput with a **cw** signal generator such as an HP 8640B (SG 504 channels 26 through 83). Set the generator output frequency at the center frequency of the down converter. See Table 4-2 for channel frequencies.

c. Push in the 1450-1 Man button, and set the Manual Gain control fully counterclockwise (minimum attenuation).

d. Monitor the down converter IF OUTput with a spectrum analyzer such as a TEKTRONIX 7L13. Inset a step attenuator between the down converter and the spectrum analyzer, and set the step attenuator for 0 dB attenuation. Set the generator output for +1 dBm at the SYSTEM RF Input. See Fig. 4-7. Connect the spectrum analyzer Video Out to a differential amplifier such as a TEKTRONIX 7A22.

e. Calibrate the differential amplifier for 0.2 dB/Div. Refer to step 3 in the Performance Check Aids preceding the performance checks.

f. Once the vertical plug-in has been calibrated, the HP 8640B can be swept manually and a grease pen used to mark the excursion of the top of the trace on the implosion shield or graticule of the test oscilloscope. The HP 8640B must be manually swept 3 MHz above and below the system center frequency. Reset the HP 8640B frequency to the system center frequency.

g. Add 1 dB of attenuation to the HP 8640B signal and use the 1450-1 Manual Gain control to set the top of the new trace at the grease pen trace.

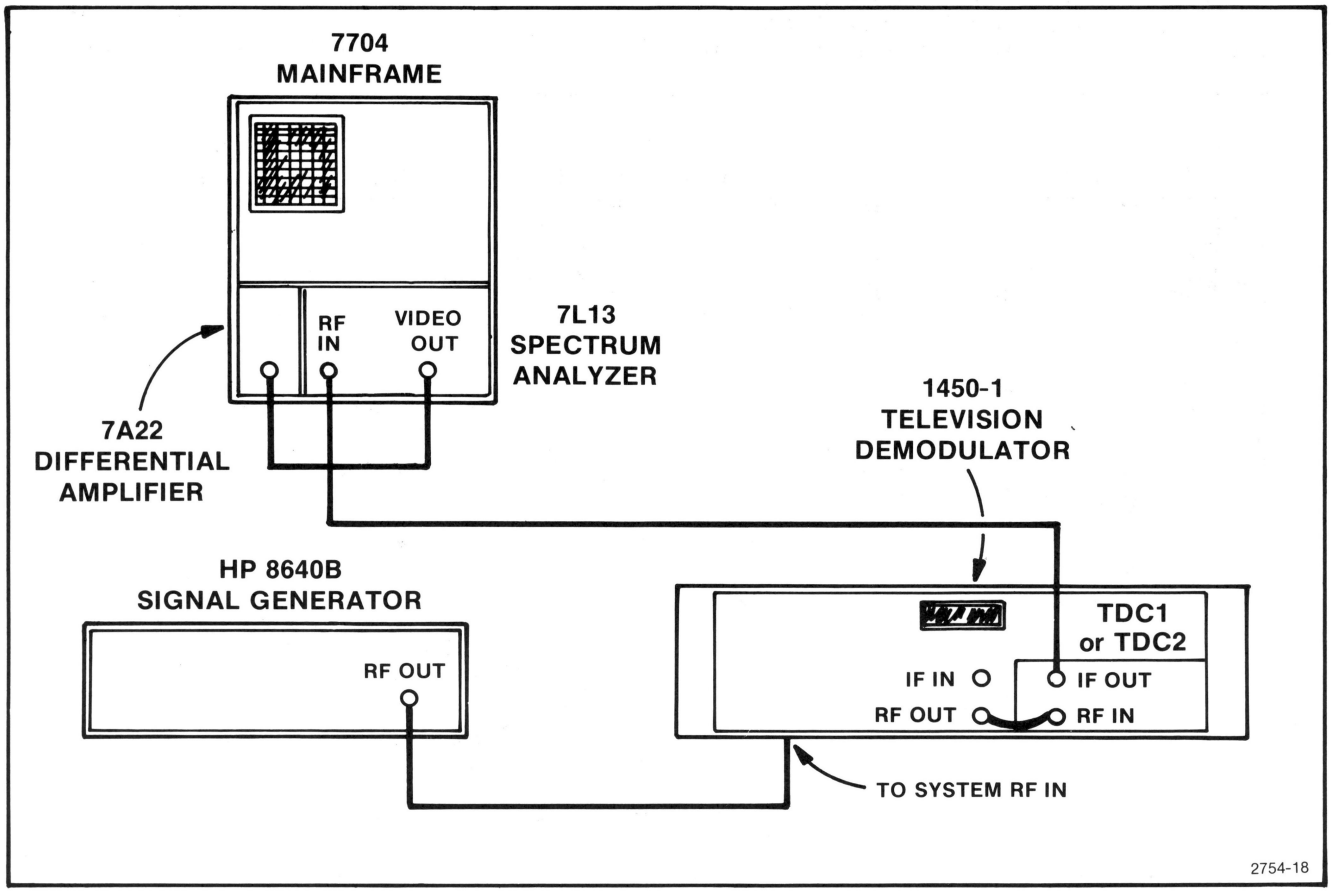


Fig. 4-7. Test Setup for Measuring Variation in Frequency Response as a Function of AGC.

h. Vary the HP 8640B 3 MHz above and below the center frequency.

i. Check that the excursion of the top of the trace is within 0.25 dB of the grease pen trace.

j. Continue to add 1 dB of attenuation to the HP 8640B signal and perform parts d through f until a total of 22 dB of attenuation has been added to the HP 8640B output (that is, until the entire down converter **agc** range has been exercised).

13. Check System Signal-to-Noise Ratio and Noise Figure (S/N = 58 dB or better) (Noise Figure = 19 dB or less)

NOTE

Signal-to-noise ratio may be measured when the down converter is driven with **rf** *signals between +1 dBm and −25 dBm; and noise figure measured when the down converter is driven with* **rf** *signals less than −25 dBm.*

a. Install the down converter in the 1450-1 mainframe, and make the appropriate front-panel connections to complete the SYSTEM. Remove the top dust cover from the 1450-1 to gain access to the Phase Lock Switch board (A58) located behind the front panel to the left. Move the jumper on P60 from pins 1 and 2 to pins 2 and 3. This puts the 1450-1 in 'Forced' Synchronous Detection Mode. Push in one of the Synchronous Detection Mode buttons on the 1450-1 front panel.

b. Connect the test equipment as shown in Fig. 4-8. Push in the 1450-1 Man button on the front panel, and set the Manual Gain control such that the **rf** Input Power Level readout indicates −20 dBm.

c. Read the **rms** voltage directly on the **rms** voltmeter. This is the **rms** noise voltage.

NOTE

The specification for signal-to-noise ratio expressed in dB is equal to: 20 X Log (1 V p-p video/0.74 mV **rms** *noise) = 60 dB*

Replacing 0.714 mV **rms** *in the preceding formula with the measured* **rms** *voltage will result in the signal-to-noise ratio.*

d. Check that signal-to-noise ratio is at least 60 dB, or the measured **rms** voltage in part c is less than 0.714 mV **rms**.

e. Reset the 1450-1 Manual Gain control to indicate any power level between −45 dBm and −66 dBm. Read the **rms** voltage indicated on the **rms** voltmeter, and recalculate the signal-to-noise ratio for this new gain setting. This new signal-to-noise ratio value will be used to calculate the noise figure.

NOTE

Noise figure is equal to the absolute value of the KTB Thermal Noise Floor (−101 dBm for this system) minus the sum of the absolute values of the **rf** *Input Signal Power and the signal-to-noise ratio as*

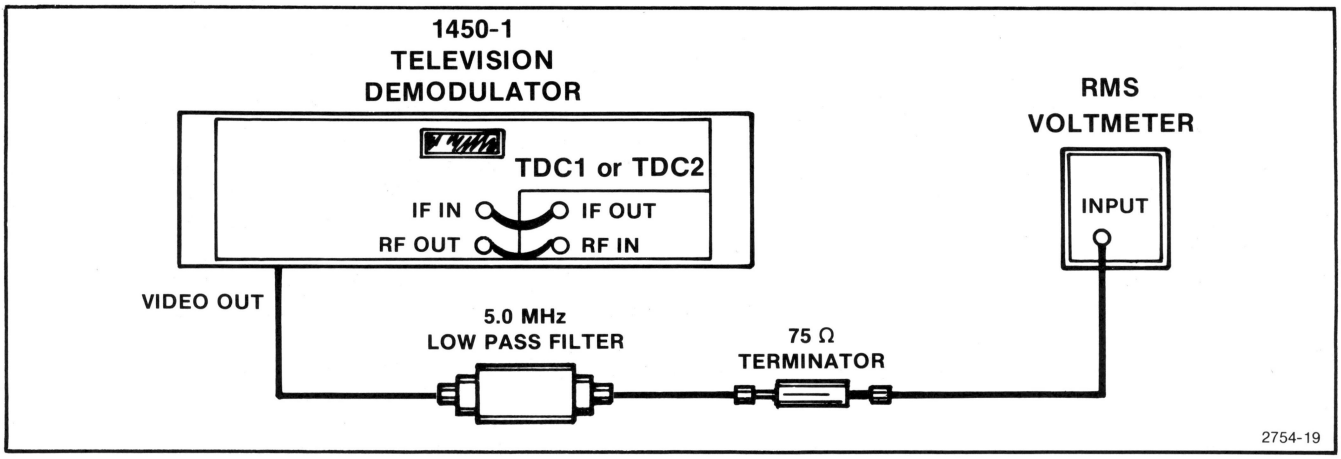


Fig. 4-8. Test Setup for Measuring Signal-to-Noise Ratio.

measured by the above method at an **agc** *setting to correspond to the* **rf** *input level used.*

EXAMPLE

Set the 1450-1 Manual Gain control to indicate −60 dBm on the **rf** *Signal Input Level readout. If the measured signal-to-noise ratio for this manual* **agc** *setting is 26 dB, then the noise figure would be:*

NF = 101 dB − (60 dB + 26 dB) = 15 dB

f. Check that the noise figure is 19 dB or less.

14. Check Low Frequency Phase Noise (0.5° rms or less)

a. Refer to Fig. 4-9. Drive the test modulator with a linearity staircase signal from a video test signal generator such as a TEKTRONIX 1410/TSG3/SPG combination. Connect the low phase noise signal generator to the test modulator **ext lo** input. Connect the test modulator **rf** output to the 1450-1 (SYSTEM) **rf** input, and make the appropriate front-panel connections on the 1450-1 to complete the SYSTEM.

b. Connect the 1450-1 Quadrature output to a 1480 Waveform Monitor External Horiz In through a 250-kHz Low-Pass Filter (Tektronix Part No. 015-0532-00), and the Video Output to the 1480 A Input. Install an external phase graticule (Tektronix Part No. 331-0393-12) in the 1480 Waveform Monitor.

c. Set the 1480 Response switch to Low Pass, Input to A DC CPL'D, Magnifier to X25 (2°), and Display to Ext.

d. Tune the down converter to the specific channel to be tested, and phase-lock.

e. Check that the 1480 display does not have any peak-to-peak swings of more than 2.5 major divisions, that its **rms** position does not move more than one half of a major division.

15. Check SYSTEM Agc Range (66 dB)

a. Install the down converter in a 1450-1 mainframe, and tune it to channel 8 or channel 25.

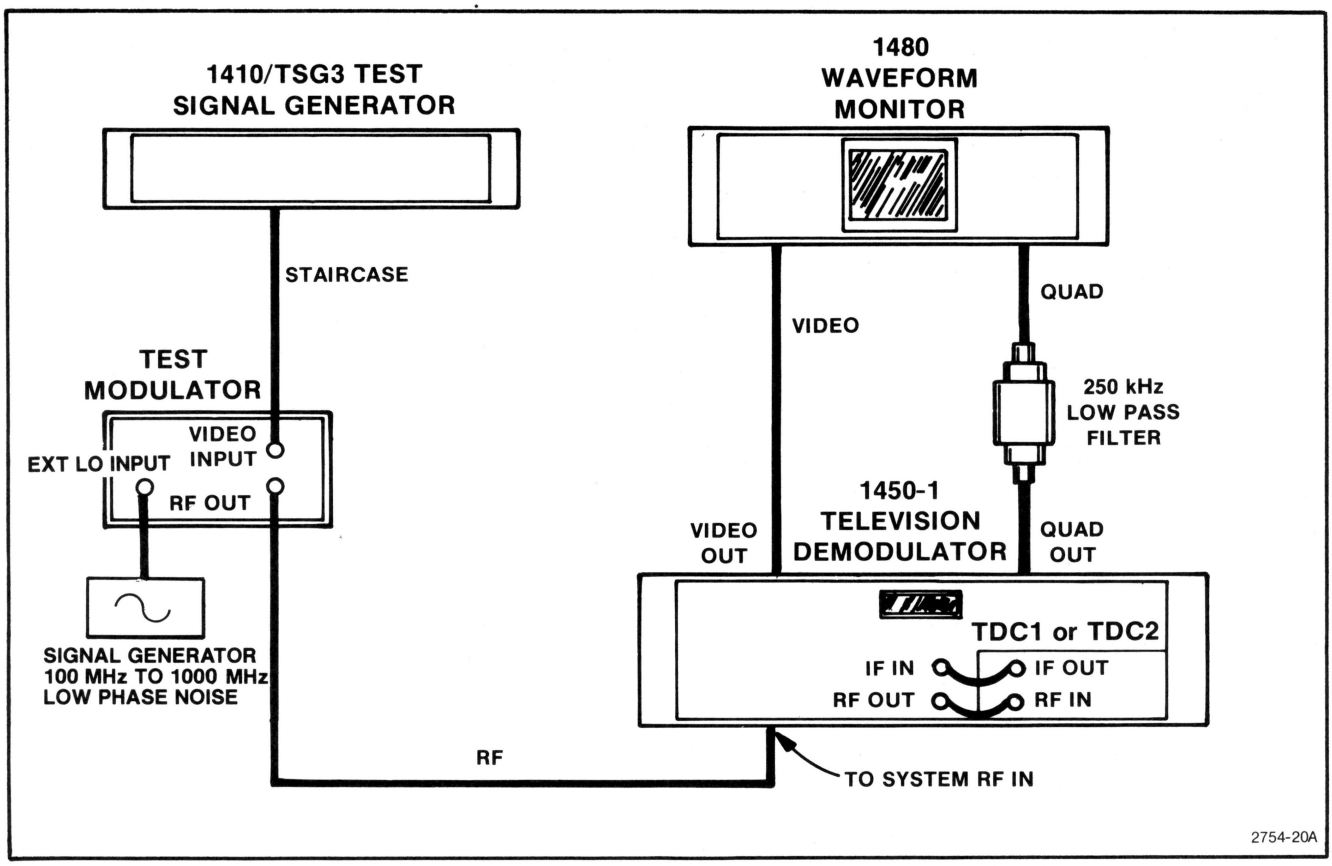


Fig. 4-9. Test Setup for Measuring Low Frequency Phase Noise.

b. Connect a **cw** signal generator such as an HP 8640B to the 1450-1 SYSTEM RF IN. Set the signal generator output frequency at the SYSTEM visual carrier frequency and the output level at +0.7 dBm. Use a power meter such as an HP 435A to verify the generator output power level. Push in the SYNC TIP (AUTO AGC) button on the 1450-1 front panel.

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

b. Check that the 1450-1 Rf signal Input Level readout indicates +0.7 dBm ±1 dB, and check that the 1450-1 High/Low lights on the 1450-1 Rf Signal Input Level readout remain "off".

c. Reset the signal generator output level to −65.1 dBm.

d. Check that the 1450-1 readout indicates a −65.1 dBm ±1 dB input power level, and check that the High/Low lights on the readout panel remain off.

e. Check that the 1450-1 Rf Signal Input Level readout tracks for all generator output power levels between 0.7 dBm and −65.1 dBm within ±1 dB.

16. Check Adjacent Channel and 2nd Adjacent Channel Cross-modulation (60 dB or less)

a. Connect the test equipment as shown in Fig. 4-10, and tune the down converter to a specific channel. Use a spectrum analyzer such as a 7L13 to set the power levels at point 'A' in Fig. 4-10 according to the following table:

HP 8640B Channel Carrier	SG 503/504 (1) Adjacent Channel Carrier	SG 503/504 (2) Adjacent Channel Carrier +1 MHz
−28 dBm	−28 dBm	−34 dBm

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.

b. Now connect point 'A' in Fig. 4-10 to the SYSTEM RF Input. Push in the 1450-1 Cont (Synchronous Detection Mode), Sound Trap In, and Man buttons. Set the 1450-1 Manual Gain control for a −21.0 dBm indicated Rf Signal Input Level on the 1450-1 readout.

c. Use a dc-blocking capacitor to monitor the SYSTEM Video Output with the spectrum analyzer. Set the spectrum analyzer Center Frequency to view baseband video (0 to 10 MHz), and Freq Span/Div at 1 MHz.

d. Tune the down converter to the adjacent or 2nd adjacent channel depending on the test being made (adjacent channel or 2nd adjacent channel cross-mod).

Set the spectrum analyzer for this channel sideband signal to be at the top of the crt display. This establishes the measurement reference. Now retune the down converter to the original channel.

e. Locate the adjacent channel cross-modulation signal at 1 MHz on the spectrum analyzer display above the zero marker.

f. Check that the adjacent channel cross-modulation signal is 60 dB down from the top of the screen, that is, from the reference established in part d (60 dB down from the adjacent channel sideband level).

g. Reset the Generator (1) and Generator (2) frequencies to the 2nd adjacent channel frequencies, and perform parts a through e.

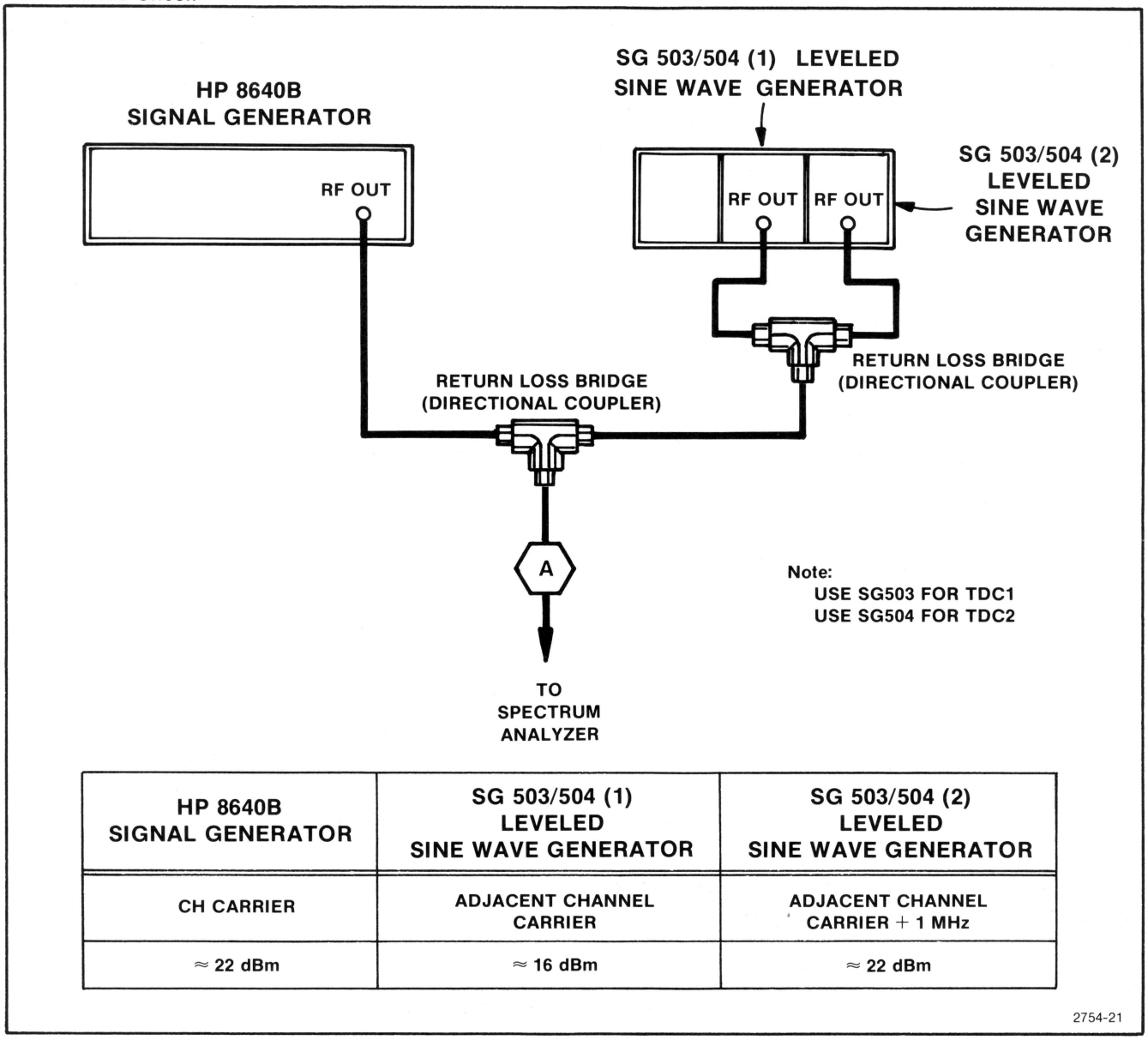
17. Check Chrominance Carrier/Aural Carrier/Visual Carrier Intermodulation (60 dB)

a. Connect the test equipment as shown in Fig. 4-11. Use a spectrum analyzer such as a 7L13 to set the power levels at point 'A' in Fig. 4-11 according to the following table:

Visual Carrier HP 8640B	Chrominance Carrier SG503/504 (1)	Aural Carrier SG 503/504 (2)
−20 dBm	−32.5 dBm	+23.5 dBm

NOTE

Connect the HP 8640B to the test setup through a Doubler (HP10510A) and a 2X attenuator when checking TDC2 channels 26 through 83.



HP 8640B SIGNAL GENERATOR	SG 503/504 (1) LEVELED SINE WAVE GENERATOR	SG 503/504 (2) LEVELED SINE WAVE GENERATOR
CH CARRIER	ADJACENT CHANNEL CARRIER	ADJACENT CHANNEL CARRIER + 1 MHz
≈ 22 dBm	≈ 16 dBm	≈ 22 dBm

Fig. 4-10. Test Setup for Measuring Adjacent Channel Cross-modulation.

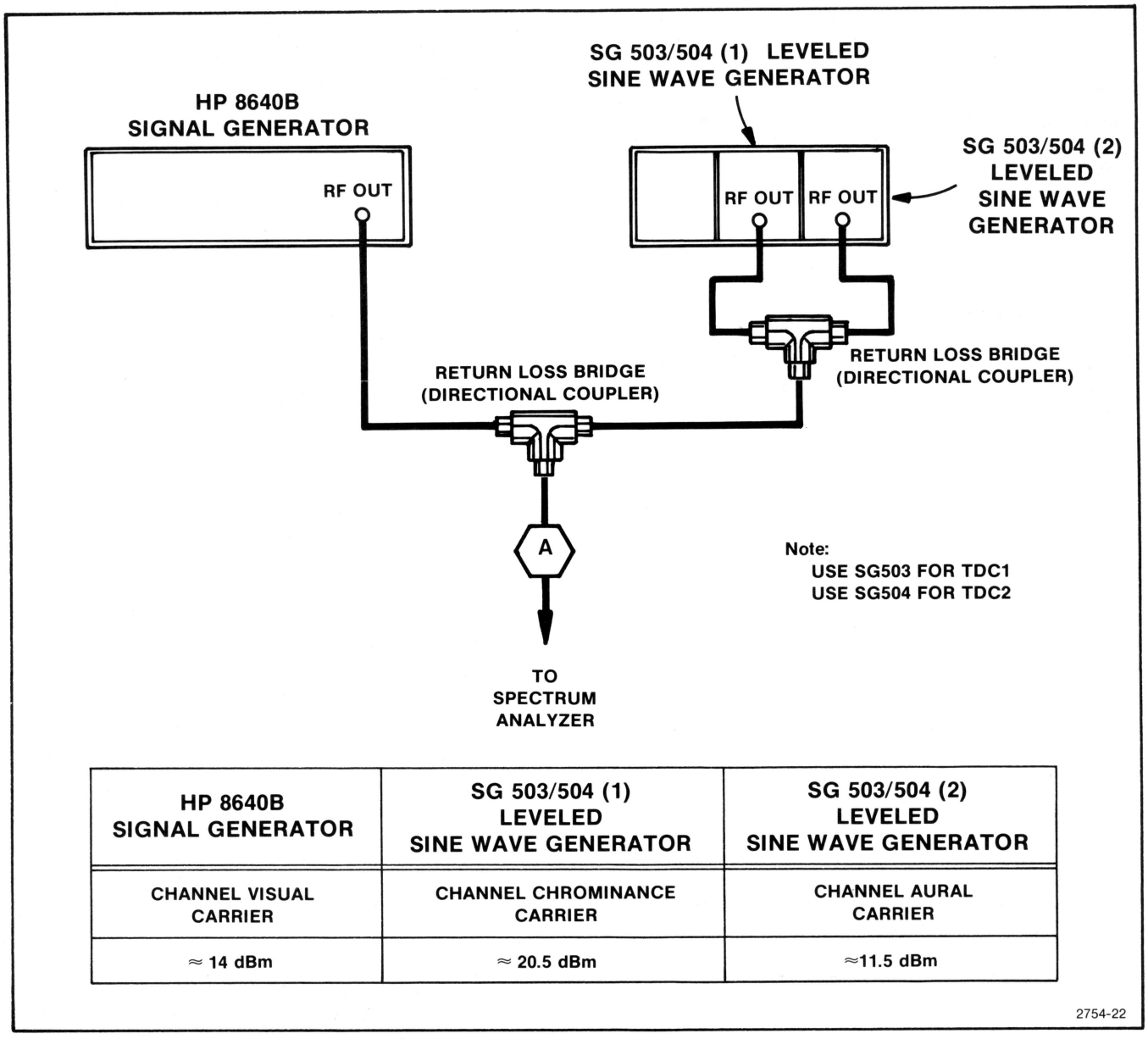
b. Now connect point 'A' in Fig. 4-11 to the SYSTEM RF Input. Push in the 1450-1 Cont (Synchronous Detection Mode), Sound Trap Out, and Sync Tip buttons. The 1450-1 Unlocked light should be "off". If the Unlocked light is "on", disconnect the aural carrier from the test setup momentarily. The 1450-1 Unlocked light should remain "off" throughout this step. Note the 1450-1 readout indication.

c. Push in the 1450-1 Man button, and set the Manual Gain control such that the readout indication is 3.5 dB higher than was noted in part b.

d. Use a dc-blocking capacitor to monitor the SYSTEM Video Output with the spectrum analyzer. Set the spectrum analyzer Center Frequency at 1 MHz, and Freq Span/Div at 1 MHz.

e. Locate the carrier intermodulation signal and the aural signal at 920 kHz and 4.5 MHz respectively on the spectrum analyzer display.

f. Use the spectrum analyzer attenuator and Variable gain controls to position the aural carrier at the top of the graticule area. Push in the 1450-1 Sound Trap In button.



HP 8640B SIGNAL GENERATOR	SG 503/504 (1) LEVELED SINE WAVE GENERATOR	SG 503/504 (2) LEVELED SINE WAVE GENERATOR
CHANNEL VISUAL CARRIER	CHANNEL CHROMINANCE CARRIER	CHANNEL AURAL CARRIER
≈ 14 dBm	≈ 20.5 dBm	≈11.5 dBm

Fig. 4-11. Test Setup for Measuring Chrominance Carrier/Aural Carrier/Visual Carrier Intermodulation (3 Tone Test).

g. Check that the carrier intermodulation signal is at least 53 dB less than the aural signal as referenced on the spectrum analyzer with Sound Trap Out.

NOTE

The specification is referenced to the visual carrier at full power (full power being the carrier level when the 1450-1 is in Auto AGC). The visual carrier is now at −3.5 dB from full power, and the aural carrier is at −7 dB from full power.

18. Check Variation in System Frequency Response (±0.3 dB or less, that is ±2.5% or less)

a. Connect the output of a field sweep generator, such as a TEKTRONIX 1410/TSG6/SPG video test signal generator, to a waveform monitor. Set the waveform monitor front-panel controls for a 2 Field display, and 0.2 V full scale. Use the Vertical Position control on the waveform monitor to bring the top of the display within the viewing area.

b. Use a grease pen to mark the top of the 2 Field display on the waveform monitor graticule shield. Now position the bottom of the waveform monitor display within the viewing area. Again, use a grease pen to mark the bottom of the display on the waveform monitor graticule shield. These will be the reference flatness of the field sweep generator.

c. Connect the test equipment as shown in Fig. 4-12. Use the Vertical Position control on the 1480 to bring the top of the display onto the viewing area.

d. Check that the total amplitude deviation of the combination of both the upper and lower envelopes of the field sweep displays is less than ±2.5 IRE from 100 kHz to 4 MHz.

e. Push in the Sound Trap Out button on the 1450-1 front panel and make the same check as in part b except from 100 kHz to 5 MHz.

f. Make the checks associated with this step for all channels.

19. Check SYSTEM Readout Accuracy (±2 dB)

a. Install the down converter in 1450-1 mainframe, and tune it to a specific channel.

b. Calibrate a step attenuator using a signal generator such as an HP 8640B (SG 504 channels 26 through 83), a power meter, and a step attenuator such as a TEKTRONIX 2701.

c. Reset the step attenuator to 0 dB. Set the output from the step attenuator to +1 dBm by adjusting the signal generator output level with a power meter. Connect the output signal from the step attenuator to the 1450-1 RF In.

d. Check that the readout on the 1450-1 indicates +1 dBm ±1 dB.

e. Switch in attenuation from 1 dB to 66 dB, using the calibrated step attenuator.

f. Check that the 1450-1 readout indicates the correct input power level within 1 dB across the **agc** range.

20. Check Readout Resolution (±0.1 dB)

a. With the 1450-1 Gain button pushed in, vary the GAIN control from maximum (+1 dBm) to minimum (−65 dBm).

b. Check that the readout increases smoothly in 0.1 dBm steps as the Gain control is varied from fully counterclockwise to fully clockwise.

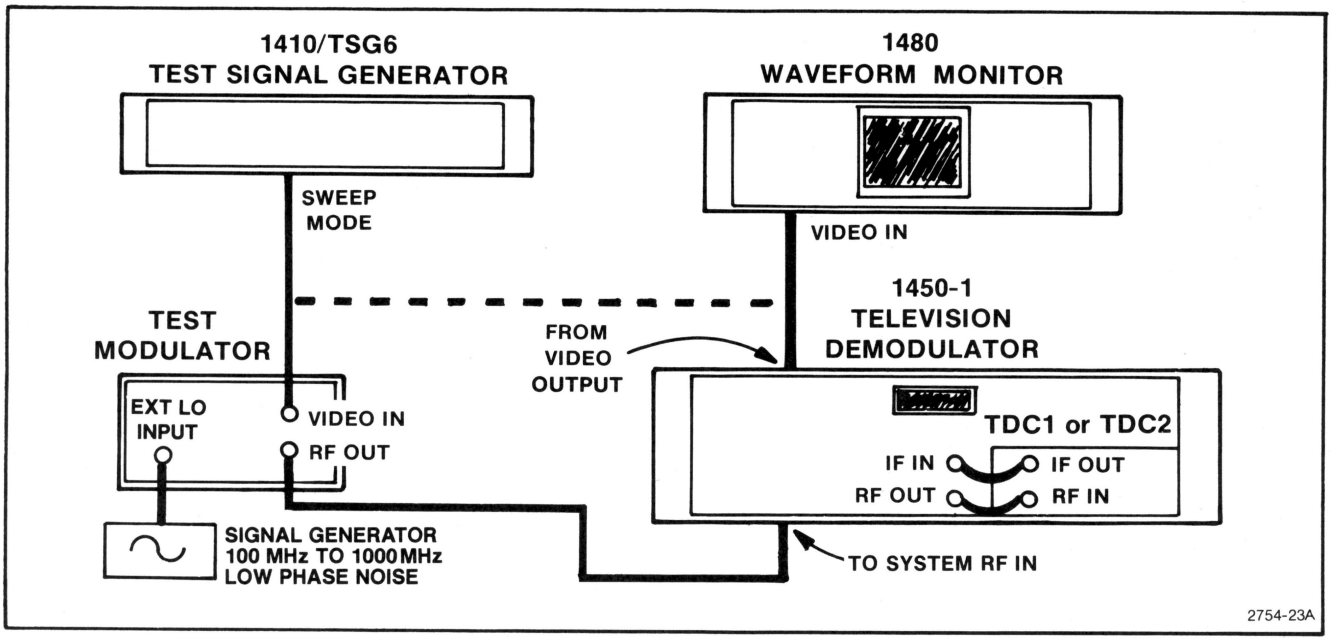


Fig. 4-12. Test Setup for Measuring Variation in Frequency Response.

ADJUSTMENT PROCEDURE

Short-Form Adjustment Procedure

1. Adjust 1st LO Tracking (C10 and C20 on A8 1st LO, see Fig. 4-13) 4-21
2. Adjust PLL Sampler Offset (R86 and R63 on A9 1st LO PLL board) 4-22
3. Adjust PLL Offset Voltage (R62 on A9 1st LO PLL board) 4-23
4. Adjust Optocoupler (Q25 mounted on the 1st LO) 4-23
5. Adjust 2nd LO (C12, C26, C51, C60, C70, C80, C78, and C85 on A11 2nd LO board) 4-23
6. Check 1st IF Amp A5 Input and Output Return Loss, and Power Gain (Return loss better than 20 dB) (Power Gain = 21 dB ±0.5 dB) 4-24
7. Adjust 1st IF Bandpass Filters (C55A, C55B, C82, and C87 on A4 and A6 IF Bandpass Filters) 4-24
8. Adjust Bandpass Center (C88 on A3 1st Mixer board) 4-26
9. Adjust Input Bandpass Filter (A2 Pin Attenuator board) (C17, C35, C45, and C54 in TDC1) (C28, C34, C36, C48, and C53 in TDC2) 4-26
10. Check 2nd Mixer Output Level (R53 on A7 2nd Mixer board) 4-27
11. Adjust Down Converter Maximum Insertion Gain and Overall Flatness (C88 on A3 1st Mixer board—max gain) (C55A, C55B, C82, and C87 on A6 Bandpass Filter) 4-27
12. Adjust Down Converter Insertion Gain (R53 on A7 2nd Mixer board) 4-27

ADJUSTMENT PROCEDURE

Install the down converter in the 1450-1, using an extender cable (Tektronix Part No. 067-0899-01).

1. Adjust 1st LO Tracking (C10 and C20 on A8 1st LO, see Fig. 4-13)

NOTE

A11 1st LO outputs should be terminated in 50 Ω for all tracking adjustments.

The 1st LO assembly is factory adjusted to track the oscillator with the frequency-indicating tape. If adjustment of the 1st LO assembly becomes necessary, refer to Fig. 4-13 and perform the following procedure.

a. The adjustment for the low number channels (C10) is located at the back of the 1st LO assembly, and can be reached by removing the shield cover over the 2nd LO and 2nd Mixer boards. See Fig. 8-1. There is an access hole through the chassis for this adjustment. Also, there is a setscrew on the side of the assembly that has to be loosened before the adjustment can be made. See Fig. 4-13.

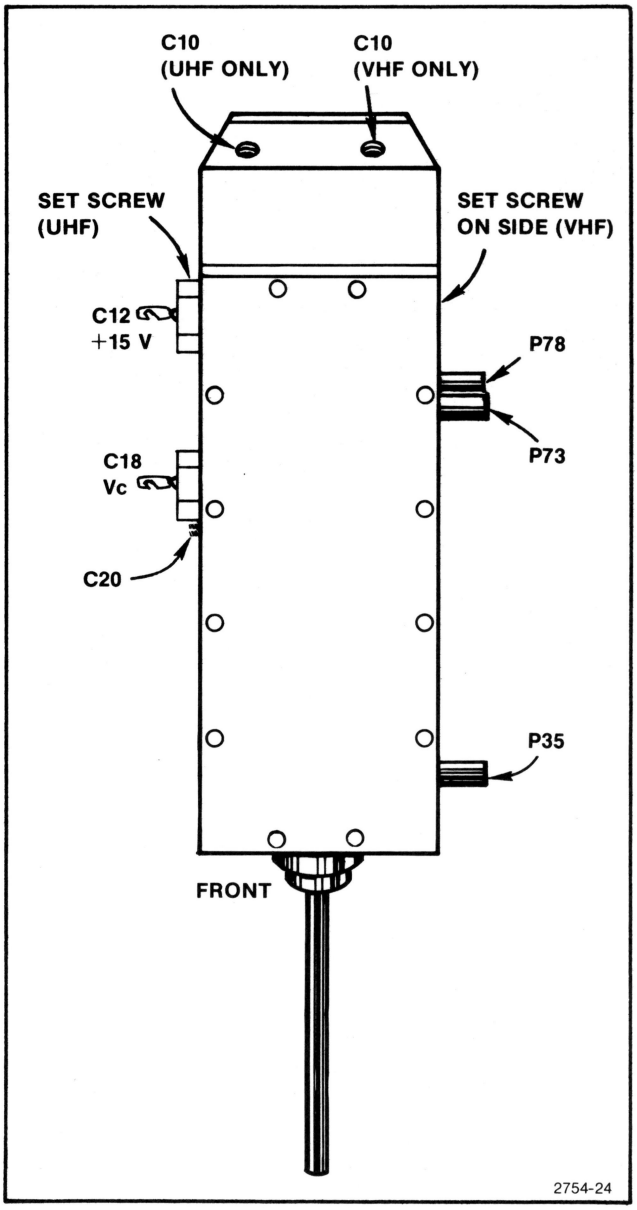


Fig. 4-13. 1st LO Tracking Adjustment Locations.

b. The adjustment for the high number channels (C20) is located at the side of the 1st LO assembly. This adjustment can also be reached through a hole on the instrument side.

c. Push in the down converter PHASE LOCK LOOP switch, and monitor the 1st LO OUT with a frequency counter through at least a X2 attenuator. Set the TUNE control on the down converter such that the frequency counter indicates 618 MHz (channel 8 1st LO frequency) if adjusting a TDC1, or 1176 MHz (channel 58 1st LO frequency) if adjusting a TDC2.

NOTE

Local oscillator frequencies up to channel 28 **lo** *can be measured with a TEKTRONIX DC 508 Frequency Counter. Lo frequencies for channels 29 through 83 may be measured using a spectrum analyzer and a* **cw** *signal source in the following manner.*

Drive the spectrum analyzer **rf** input with the signal source, and set the signal source frequency to one half the **lo** frequency to be measured or observed. Set the spectrum analyzer front-panel controls to view the 2nd harmonic of the signal source frequency. The 2nd harmonic should fall on the same spot where the **lo** would normally be. Do not disturb the spectrum analyzer front-panel controls once the 2nd harmonic (reference) has been located. Now, monitor the down converter LO OUTput with the spectrum analyzer. The **lo** can now be measured or adjusted to fall on the same spot as the 2nd harmonic (reference).

d. Use a 0.05" Allen wrench to release the gear on the 1st LO tuning shaft. Rotate the tape-drive gear until the channel number "8" (if TDC1) or number "58" (if TDC2) is centered on the front-panel window. Re-engage the tuning shaft gear, and secure it to the tuning shaft with the two set screws.

e. Tune the dial tape to the center of the shaded area for channel V, and check that the frequency counter indicates 726 MHz if adjusting a TDC1. Tune the dial tape to channel 82 (the number "82" centered) if adjusting a TDC2, and check that the frequency counter indicates 1320 MHz.

f. Adjust C20 at the side of the 1st LO assembly such that the frequency counter indicates 726 MHz if adjusting a TDC1 or 1320 MHz if adjusting a TDC2.

g. For the TDC1, tune the dial tape to the center of the shaded area for channel 3, and check that the frequency counter indicates 498 MHz. For the TDC2, tune the dial tape to channel 15 and check that the frequency counter indicates 918 MHz.

h. Adjust C10 at the rear of the 1st LO assembly such that the frequency counter indicates 498 MHz if adjusting a TDC1, or 918 MHz if adjusting a TDC2.

i. Tune the down converter through its range, and check that all channels have corresponding **lo** frequencies according to Table 4-1.

NOTE

It may be necessary to repeat parts c through h to satisfy part i.

j. Replace the shield cover over the 2nd LO and 2nd Mixer boards.

k. Monitor the down converter 1st LO OUTput with a spectrum analyzer set to view signals with frequencies from 492 MHz to 732 MHz if adjusting a TDC1, or 912 MHz to 1326 MHz if adjusting a TDC2.

l. Tune the down converter from the lowest number channel to the highest, and note the spectrum analyzer display.

m. Check that the spectrum analyzer display tracks the TUNE control. Also check that there are no frequency jumps as the TUNE control is varied over the entire range of the down converter.

n. Repeat parts k through m for the **lo** output to the 1st Mixer (P73 on A8) and 1st LO Return (P35 on A8).

NOTE

The **lo** *power level at the 1st LO OUTput and 1st LO output to the 1st Mixer is about +10 dBm, and the 1st LO Return power level at (35 on A8 is about +4 dBm.*

2. Adjust PLL Sampler Offset (R86 and R63 on A9 1st LO PLL board)

a. Remove the harmonica connectors from P83 on A9 (1st LO PLL board), and from C58 on A13 (Interconnect board).

b. Release the down converter PHASE LOCK LOOP switch (turn the phase lock loop on).

c. Monitor TP85 with the test oscilloscope. Set the TUNE control for minimum periodic signal at TP85.

d. Adjust R86 to center this periodic signal about 0 V.

e. Set PLL Gain (R63) on A9 fully clockwise, and monitor TP73 on A9 with the test oscilloscope (dc coupled).

f. Readjust R86 on A9 to center the signal at TP73 about 0 V.

3. Adjust PLL Offset Voltage (R62 on A9 1st LO PLL board)

a. Monitor TP90 on A9 with a digital multimeter. Check to see that PLL Gain (R63) on A9 is fully clockwise, and set the TUNE control for minimum periodic signal at TP73.

b. Adjust R62 for 7 Vdc at TP90.

c. Replace the harmonica connectors to P83 on A9 and C58 on A13.

d. Monitor the 1st LO OUTput with a spectrum analyzer, and monitor C58 on A13 (TDC Interconnect board) with a test oscilloscope.

e. Push the down converter PHASE LOCK LOOP switch, and tune the down converter from the lowest number channel to the highest number channel.

f. Check that Vc (the dc voltage at C58 on A13) changes smoothly between 0V and +11V. Also check that the 1st LO locks to all channels with spurs down 80 dB or more.

4. Adjust Optocoupler (Q25 mounted on The 1st LO)

NOTE

This step applies to the TDC1 only.

a. Check that the PHASE LOCK LOOP switch is in the "on" position (out).

b. Monitor TP38 on A9V (1st LO PLL board) with a frequency counter using a X1 probe. Dial the TUNE control from channel 2 to channel 4, and note that the frequency counter indicates 6.000 MHz. Now dial the TUNE control to channel 5. The frequency counter should indicate 5.977 MHz.

c. Dial the TUNE control to channel 6 and note that the frequency counter still indicates 5.977 MHz.

d. Now, dial the TUNE control to channel A and note that the frequency counter indicates 6.000 MHz. Normally, the 6-MHz crystal is active for channel 2 through channel 4 and channel 7 through channel 13, including CATV channels A through W, while the 5.977-MHz crystal is active for channel 5 and channel 6.

NOTE

Do not adjust the optocoupler (Q25) if the frequency counter changes readings between channel 4 and channel 5, and between channel 6 and channel 7.

e. Dial the TUNE control to channel 5. Loosen the two set screws holding Q25 (optocoupler) to the bracket with a 0.035" Allen wrench.

f. Adjust Q25 by moving it closer to or further away from the dial tape until the frequency counter indicates 5.977 MHz.

g. Dial the TUNE control from channel 2 to channel W while checking to see that the tape does not scrape against Q25, and the crystals switch as described in part d.

5. Adjust 2nd LO (C12, C26, C51, C60, C70, C80, C78, and C85 on A11 2nd LO board)

a. Connect a X1 probe from the tap wire on L21 to the spectrum analyzer **rf** input. Set the spectrum analyzer front panel to display the 2nd LO crystal frequency. Refer to Table 4-3 for 2nd LO frequencies.

b. Adjust C26 to produce oscillations at the 2nd LO crystal frequency, and maximum amplitude.

NOTE

This is a fifth overtone crystal, and in some cases it may oscillate at a frequency other than the one listed in Table 4-3 (usually lower). Check for correct overtone.

c. Adjust C12 on A11 for maximum signal amplitude as viewed on the spectrum analyzer. See Table 4-3.

Table 4-3

2nd LO AND 2nd LO CRYSTAL FREQUENCIES

2nd IF	2nd LO	2nd LO Crystal
37.00 MHz	395.00 MHz VHF	133.250 MHz VHF
(Option 1)	403.75 MHz UHF	134.583 MHz UHF
38.90 MHz	397.85 MHz VHF	132.627 MHz VHF
(Option 2)	401.85 MHz UHF	133.950 MHz UHF
45.75 MHz	391.00 MHz VHF	130.333 MHz VHF
(Option 3)	395.00 MHz UHF	131.667 MHz UHF

d. Monitor P95 with the spectrum analyzer using a bnc-to-Conhex adapter cable (Part No. 175-0709-00). Set the spectrum analyzer front panel to display the 2nd LO frequency (3 X crystal frequency).

e. Adjust C51, C60, C70, and C80 on A11 for maximum signal amplitude as viewed on the spectrum analyzer. The signal should be approximately +10 dBm.

f. Repeat parts a through f.

g. Monitor P48 with the spectrum analyzer using a bnc-to-Conhex adapter cable (Part No. 175-2412-00).

h. Adjust C78 and C85 on A11 for maximum signal amplitude as viewed on the spectrum analyzer. The signal at P48 on A11 must not be less than +18 dBm.

NOTE

After proper adjustments of C51, C60, C70, C80, C78, and C85, the dc levels at TP53 and TP68 should be 12.5 V or more and 9.4 V or more respectively.

i. Repeat step 5 parts f through i until power and voltage requirements are satisfied.

6. Check 1st IF Amp A5 Input and Output Return Loss, and Power Gain (Return loss better than 20 dB) (Power Gain = 21 dB ±0.5 dB)

NOTE

Do not perform steps 6, 7, and 8 if the down converter meets the return loss, insertion loss, and flatness specifications.

a. Connect the test equipment as shown in Fig. 4-4, except that the vswr bridge is not connected to anything. Set the TR 502 Output Level at −20 dBm, and set the spectrum analyzer Center Frequency at 435 MHz (439 MHz for **uhf**) and Freq Span/Div at 5 MHz.

b. Note the power level display on the spectrum analyzer. This level is the reference for measuring the if amplifier return loss. Connect the vswr bridge to P03 on A5 1st IF Amp board, and note the spectrum analyzer display.

c. Check that return loss (the difference between the reference and the measurement noted in part d) is at least 20 dB.

d. Disconnect the vswr bridge from P03 and connect it to P89 on A5.

e. Check that return loss is 20 dB or better.

f. Disconnect the vswr bridge from P89, and monitor P89 with the spectrum analyzer. Connect the tracking generator output to P03 on A5. Leave the tracking generator output set at −20 dBm.

g. Check that the spectrum analyzer display is +1 dBm ±0.5 dB (gain = 21 dB ±0.5 dB).

h. Set up 0.2 dB/Div reference flatness according to step 3 in the Performance Check Aids preceding the Performance Check Procedure.

i. Check that flatness from input to output of the 1st IF Amplifier is within 0.1 dB across a 10 MHz bandpass centered about 435 MHz for TDC1, or 439 MHz for the TDC2.

7. Adjust 1st IF Bandpass Filters (C55A, C55B, C82, and C87 on A4 and A6 IF Bandpass Filters)

NOTE

Perform steps 11 and 12 in the adjustment procedure before this step. If steps 11 and 12 are satisfied, do not perform steps 7 through 10.

a. Set up a 0.2 dB reference flatness trace as per step 3 in the Performance Check Aids preceding the Performance Check Procedure.

b. Refer to Fig. 4-14. Disconnect the cable connected to P85 on A3 First Mixer board, and connect it to the tracking generator output using a bnc-to-Conhex adapter cable. Disconnect the cable connected to P03 on A5 1st IF Amp board, and connect it to the spectrum analyzer **rf** input using a bnc-to-Conhex adapter cable.

c. Set the tracking generator output level at −20 dBm, and set the spectrum analyzer front panel to view a signal centered about 435 MHz if adjusting a TDC1 or 439 MHz if adjusting a TDC2.

NOTE

Adjustment of C55A, C55B, C82, and C87 on A6 may not be necessary if bandpass and bandpass flatness meet specifications.

d. Adjust C55A, C55B, C82, and C87 on A4 for a 6 MHz bandpass, and bandpass flatness within 0.1 dB. Check that insertion loss is within 0.8 dB.

e. Reconnect the cable normally connected to P03 on A5 1st IF Amp board.

f. Disconnect the cable connected to P89 on A5, and monitor P89 with the spectrum analyzer.

g. Readjust C55A, C55B, C82, and C87 for bandpass flatness within 0.1 dB.

h. Connect the cable normally connected to P89 on A5 1st IF Amp board to the tracking generator output using a bnc-to-Conhex adapter cable. Disconnect the cable connected to P77 on A7 2nd Mixer board, and connect it to the spectrum analyzer **rf** input using a bnc-to-Conhex adapter cable.

i. Set the tracking generator output level at −20 dBm, and set the spectrum analyzer front panel to view a signal centered about 435 MHz if adjusting a TDC1 or 439 MHz if adjusting a TDC2.

j. Adjust C55A, C55B, C82, and C87 on A6 for a 6 MHz bandpass, bandpass flatness within 0.1 dB, and insertion loss within 0.8 dB.

k. Reconnect the cable to P89 on A5 1st IF Amp board.

l. Disconnect the cable connected to P85 on A3 First Mixer board, and connect it to the tracking generator output using a bnc-to-Conhex adapter cable.

m. Set the tracking generator output level at −30 dBm,

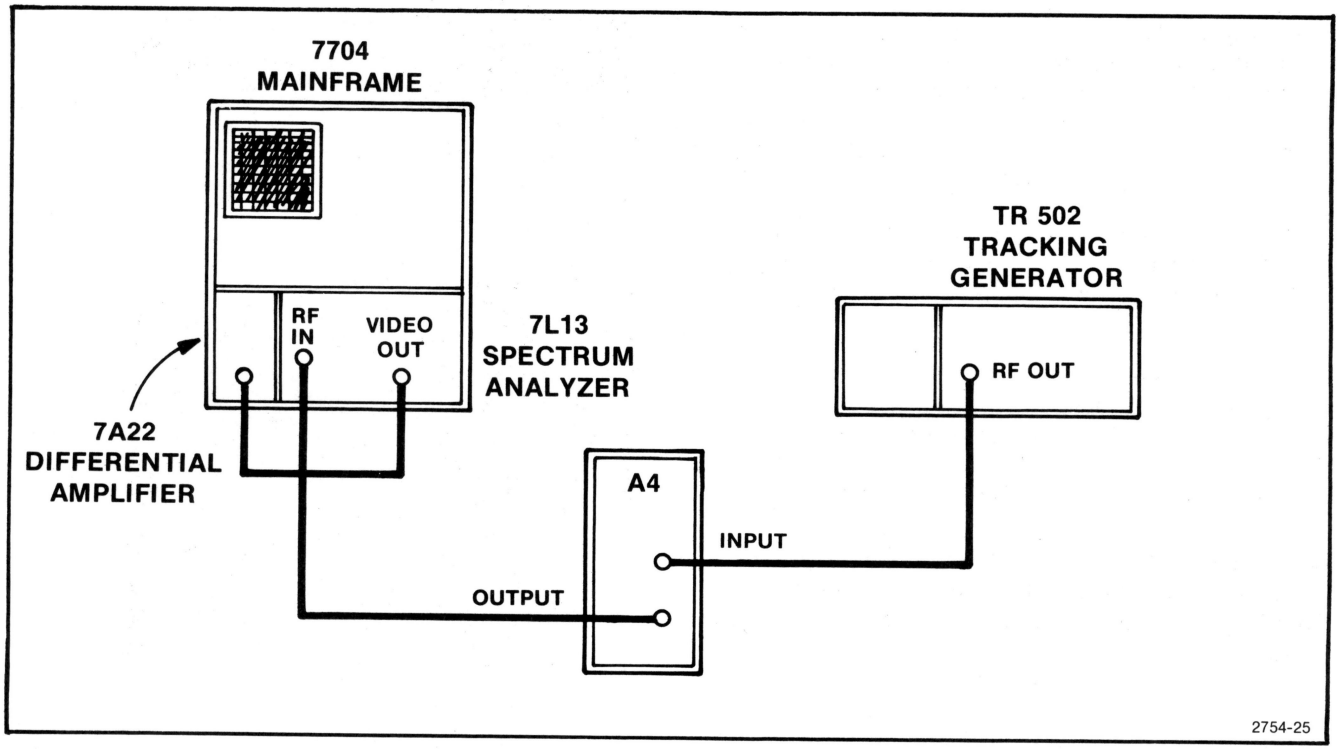


Fig. 4-14. Test Setup for Adjusting the 1st IF Bandpass Filters.

and set the spectrum analyzer front panel to view a signal centered about 435 MHz if adjusting a TDC1, or centered about 439 MHz if adjusting a TDC2 (at approximately −19.5 dBm).

NOTE

Adjustment of C55A, C55B, C82, and C87 on A6 may not be necessary if bandpass and bandpass flatness meet specifications.

n. Adjust C55A, C55B, C82, and C87 on A6 for a 6 MHz bandpass, and bandpass flatness within 0.1 dB.

o. Reconnect the cables to P85 on A3 1st Mixer board and P77 on A7 2nd Mixer board.

8. Adjust Bandpass Center (C88 on A3 1st Mixer board)

a. Set the output level of a signal generator such as an HP 8640B at −20 dBm, and the output frequency at the visual carrier of channel 8 if adjusting a TDC1 or channel 44 if adjusting a TDC2 (181.25 MHz or 651.25 MHz). Set the TUNE control for channel 8 if adjusting TDC1 or channel 44 if adjusting a TDC2.

b. Disconnect the cable normally connected to P81 on A3, and connect the signal generator to P81.

c. Disconnect the cable normally connected to P85 on A3, and monitor P85 with the spectrum analyzer. Set the spectrum analyzer front-panel controls to view the 1st IF signal (435 MHz for the TDC1 or 439 MHz for the TDC2).

d. Adjust C88 on A3 for minimum insertion loss through the mixer (approximately 7 dB).

9. Adjust Input Bandpass Filter on A2 Pin Attenuator board (C17, C35, C45, and C54 in TDC1) (C28, C34, C36, C48, and C53 in TDC2)

a. Set up 1 dB/Div flatness with the tracking generator output level set at −25 dBm, and the spectrum analzyer set for a frequency of 50 MHz to 300 MHz for TDC1 or 450 MHz to 900 MHz for TDC2. See step 3 and Fig. 4-3 in the Performance Check Aids preceding the Performance Check Procedure.

b. Connect the tracking generator **rf** output to the down converter RF IN.

c. Disconnect the cable from P81 on A3 at A3 cavity wall. Connect the cable from A2 (at A3 cavity wall) to the spectrum analyzer using a bnc-to-Conhex adapter cable (Tektronix Part No. 175-2412-00).

d. Adjust C17, C35, C45, and C54 (TDC1), or C28, C34, C36, C48, and C53 (TDC2) on A2 to match the reference flatness established in part a. Check that the insertion loss is approximately 1 dB with no fast transitions or notches in the passband. See Fig. 4-15.

NOTE

In the TDC2, C28 should be adjusted to make the notch it controls in the bandpass to be just below

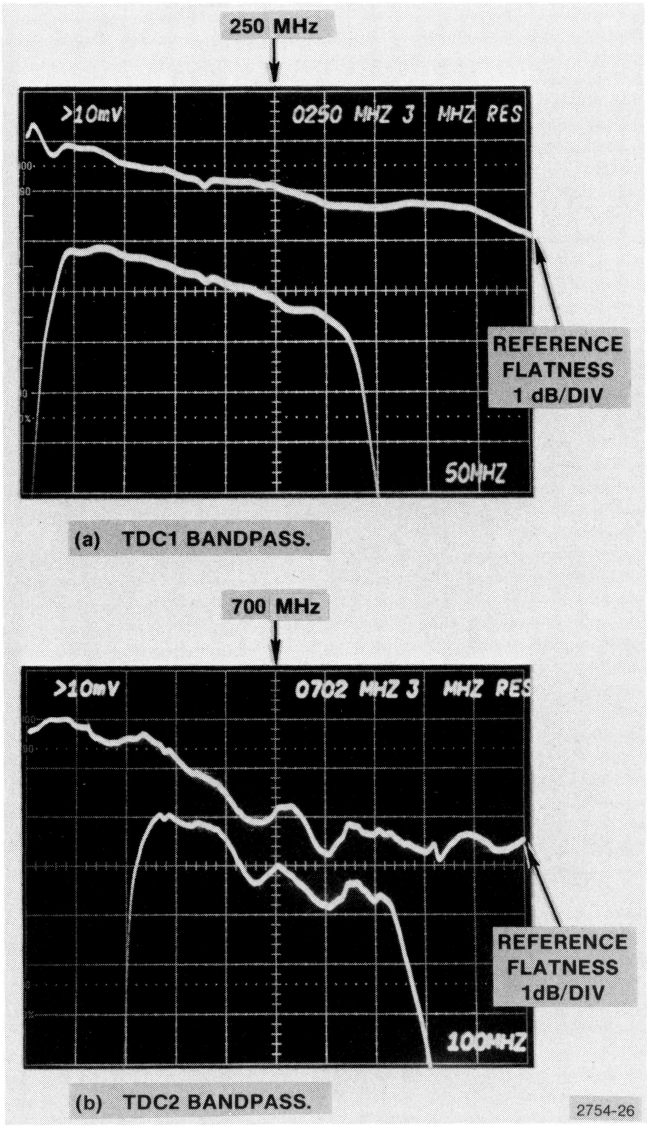


Fig. 4-15. TDC1 and TDC2 Bandpass Waveforms.

438 MHz, and such that 438 MHz is approximately 6 dB down from the response at 470 MHz.

Table 4-4

VHF AND UHF FREQUENCY RANGES

INPUT FILTER BANDPASS	
VHF	50 MHz to 300 MHz
UHF	450 MHz to 900 MHz

10. Check 2nd Mixer Output Level Range (R53 on A7 2nd Mixer board)

a. Set the output frequency of a generator (such as an HP 8640B signal generator) at 435 MHz if adjusting a TDC1 or 439 MHz if adjusting TDC2. Use a power meter to set the generator output level at −20 dBm.

NOTE

435 MHz = Center of **vhf** *1st IF*
439 MHz = Center of **uhf** *1st IF*

b. Disconnect the cable at P77 on A7 (2nd Mixer board), and connect the generator output to P77.

c. Monitor the down converter IF OUTput with a spectrum analyzer set to view the IF OUTput frequency.

d. Vary R53 on A7 and check to see that the IF OUTput signal level varies between −30 dBm and −31.5 dBm.

11. Adjust Down Converter Maximum Insertion Gain and Overall Flatness (C88 on A3 1st Mixer board—max gain) (C55A, C55B, C82, and C87 on A6 Bandpass Filter)

a. Calibrate the test oscilloscope for 0.2 dB/Div. Refer to step 3 in the Performance Check Aids preceding the Performance Check Procedure.

b. Now, connect the test equipment as shown in Fig. 4-16. Tune the down converter to channel 8 if adjusting a TDC1 or channel 44 if adjusting a TDC2. See Table 4-2 for channel frequencies.

c. Adjust C88 on A3 for maximum insertion gain through the down converter.

d. Observe the 0.2 dB/Div display on the test oscilloscope. Check that the down converter channel flatness (input to output) is within 0.25 dB for this channel. If not, proceed to part e.

e. Adjust C55A, C55B, C82, and C87 on A6 for channel flatness within 0.25 dB.

NOTE

It may be necessary to slightly readjust C88 on A3; and C55A, C55B, C82, and C87 on A4 in order to achieve channel flatness (input to output).

f. Do parts d and e for all channels.

g. Recheck the down converter input return loss. Refer to step 1 in the Performance Check Procedure. If return loss is not within specification, readjust the Input Bandpass Filter on A2. Refer to step 9 in the Adjustment Procedure, then redo step 8 parts d and e.

12. Adjust Down Converter Insertion Gain (R53 on A7 2nd Mixer board)

a. Drive the down converter RF INput with the signal generator. Set the generator frequency at 181.25 MHz (channel 8 visual carrier) if adjusting a TDC1, or 651.25 MHz (channel 44 visual carrier) if adjusting a TDC2. Tune the down converter to channel 8 if adjusting a TDC1 or channel 44 if adjsuting a TDC2. Reset the generator output level to −21 dBm using a power meter.

b. Push in the 1450-1 Man button, and set the Manual Gain control fully clockwise.

c. Adjust R53 on A7 for −20 dBm of IF OUTput power level.

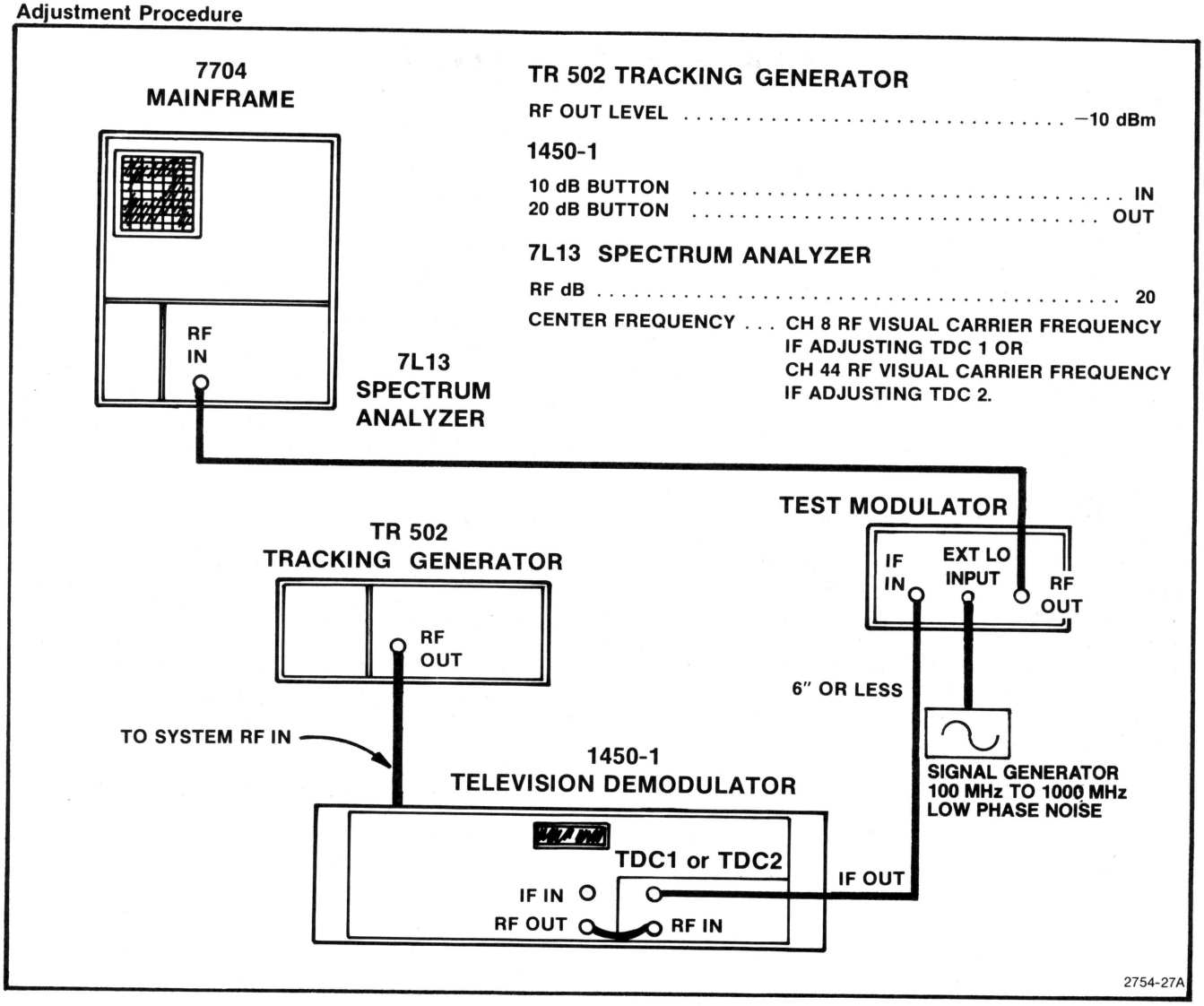


Fig. 4-16. Test Setup for Adjusting Down Converter Insertion Gain and Overall Flatness.

MAINTENANCE

Introduction

This section describes the procedure for reducing or preventing instrument malfunction, plus troubleshooting and corrective maintenance. Preventive maintenance improves instrument reliability. Should the instrument fail to function properly, corrective measures should be taken immediately; otherwise, additional problems may develop within the instrument.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, performance check, and if needed, readjustment. The preventive maintenance schedule that is established for the instrument should be based on the environment in which the instrument is operated and the amount of use. Under average conditions a preventive maintenance check should be performed every 3000 hours of instrument operation.

Cleaning

Clean the instrument often enough to prevent dust or dirt from accumulating in or on it. Dirt acts as a thermal-insulating blanket and prevents efficient heat dissipation. It also provides high resistance electrical leakage paths between conductors or components in a humid environment.

Exterior. Clean the dust from the outside of the instrument by wiping or brushing the surface with a soft cloth or small brush. The brush will remove dust from around the front-panel knobs and selector buttons. Hardened dirt may be removed with a cloth dampened in water that contains a mild detergent. Abrasive cleaners should not be used.

CAUTION

Do not allow water to get inside any enclosed assembly or components. Do not clean any plastic materials with organic cleaning solvents such as benzene, toluene, xylene, acetone, or similar compounds because they may damage the plastic.

Interior. Clean the interior by loosening accumulated dust with a dry soft brush, then remove the loosened dirt with low-pressure air to blow the dust clear. (High-velocity air can damage some components.) Hardened dirt or grease may be removed with a cotton-tipped applicator dampened with a solution of mild detergent in water. Abrasive cleaners should not be used. If the circuit-board assemblies need cleaning, remove the circuit board by referring to the instructions under Corrective Maintenance in this section. After cleaning, allow the interior to thoroughly dry before applying power to the instrument.

Visual Inspection

After cleaning, carefully check the instrument for such defects as defective connections, damaged parts, and improperly seated transistors and integrated circuits. The remedy for most visible defects is obvious; however, if heat-damaged parts are discovered, try to determine the cause of overheating before the damaged part is replaced; otherwise, the damage may be repeated.

Transistor and Integrated Circuit Checks

Static-Sensitive Components

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. See Table 1 for relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.

3. Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified personnel.

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together whenever possible.

6. Pick up components by the body, never by the leads.

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only special antistatic suction type or wick type desoldering tools.

Table 5-1

RELATIVE SUSCEPTIBILITY TO STATIC DISCHARGE DAMAGE

Semiconductor Classes	Relative Susceptibility Levels[a]
MOS or CMOS microcircuits	
or discretes, or linear	
microcircuits with MOS	
inputs (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar	
transistors	5
JFETS	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

[a] **Voltage equivalent for levels:**

1 = 100 to 500 V
2 = 200 to 500 V
3 = 250 V
4 = 500 V
5 = 400 to 600 V
6 = 600 to 800 V
7 = 400 to 1000 V (est.)
8 = 900 V
9 = 1200 V
(Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.)

Periodic checks of the transistors and integrated circuits are not recommended. The best measure of performance is the actual operation of the component in the circuit. Performance of these components is thoroughly checked during the performance check or adjustment procedures, and any substandard transistors or integrated circuits will usually be detected at that time.

Performance Check and Readjustment

The instrument performance should be checked after each 3000 hours of operation, or every six months if the instrument is used intermittently, to ensure maximum performance and assist in locating defects that may not be apparent during regular operation. Instructions for conducting a performance check are provided in the Performance Check and Adjustment section.

TROUBLESHOOTING

The following are a few aids and suggestions that may assist in locating a problem. After the defective assembly or component has been located, refer to the Corrective Maintenance part of this section for removal and replacement instructions.

NOTE

No repair should be attempted during the warranty period or performed by unqualified personnel.

Troubleshooting Aids

Foldout Pages

The foldout pages at the back of the manual contain significant information useful for troubleshooting the instrument. Block and schematic diagrams, waveforms, circuit board illustrations, parts locating charts, and IC diagrams are located on foldout pages. See Fig. 5-1.

Diagrams. Block and circuit diagrams are the most often used aids to troubleshooting. The circuit number and electrical value of each component is shown on the diagrams (see the first page in the Diagrams section for definition of the reference symbology used to identify components in each circuit). Refer to the Replaceable Electrical Parts list for a complete description of each component. Those portions of the circuit that are mounted on circuit boards or assemblies are enclosed in a gray border, with the name and assembly number shown on the border.

NOTE

Check the Change Information section at the rear of the manual for inserts describing corrections and modifications to the instrument and manual.

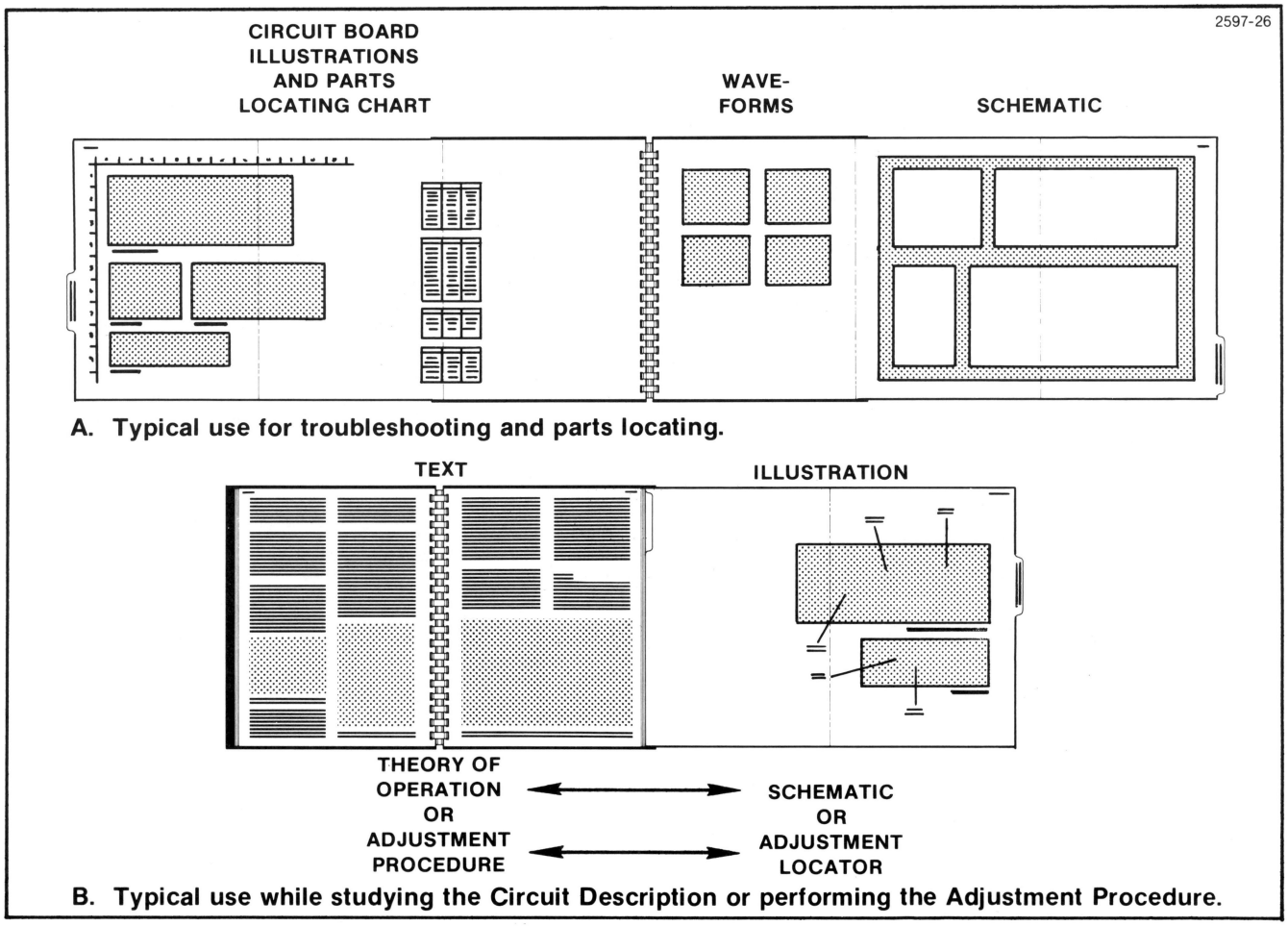


Fig. 5-1. Using the foldout pages.

Circuit Board Illustrations. Electrical components, connectors, and test points are identified on circuit board illustrations located on the inside fold of the corresponding circuit diagram, or the back of the preceding diagram.

Parts Locating Charts. The schematic diagrams and the circuit board illustrations are assigned location grids. A parts locating chart for each schematic page gives grid locations of components on both the circuit board and the facing schematic.

Assembly and Circuit Numbering

The circuit boards and other assemblies (except for the chassis and the front- and rear-panel connectors) are assigned assembly numbers that generally follow the signal path through the instrument. See Fig. 5-2.

Each component is assigned a circuit number according to its geographic location within an assembly.

The Replaceable Electrical Parts list is arranged in assembly-by-assembly order, as designated by ANSI Standard Y32.16-1975. The circuit number in the parts list is made up by combining the assembly number and the circuit number.

EXAMPLE: R25 on A61 would be listed in the parts list as A61R25.

In the case of chassis and front- and rear-panel mounted parts which have no assembly number, the parts list number is the same as shown on the schematic. Any one- or two-digit circuit number in the parts list is a part mounted on the front panel, rear panel, or the chassis.

NOTE

The parts list number should be used when ordering replacement parts.

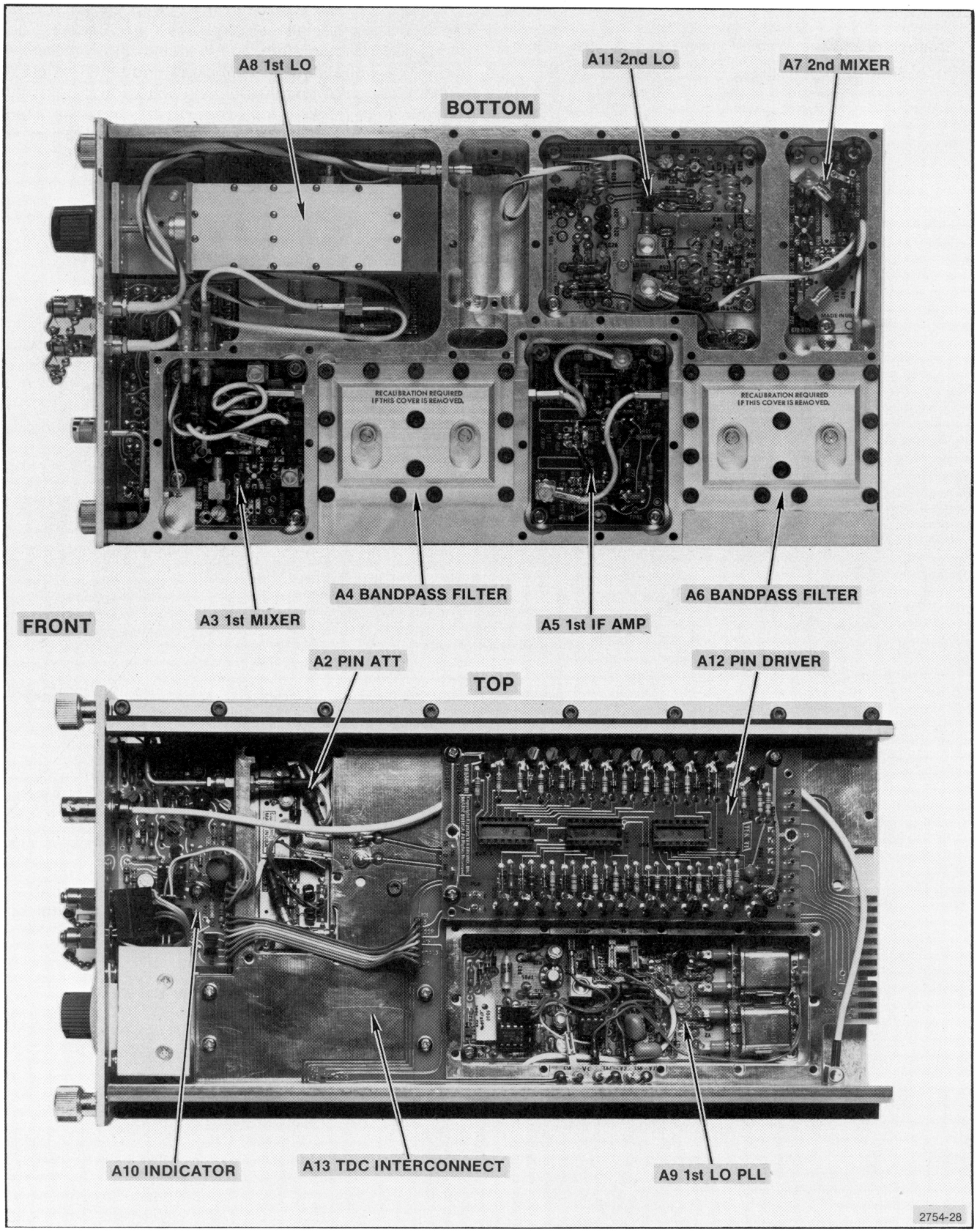


Fig. 5-2. Assembly numbers and locations.

Components

Connectors. Most signal connections are made through Peltola or Conhex coaxial connectors. See Fig. 5-3.

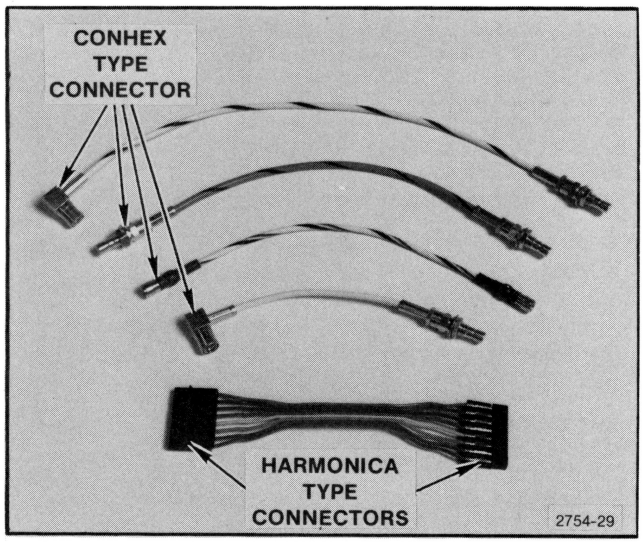


Fig. 5-3. Commonly used coaxial cable connectors.

NOTE

When reconnecting a Peltola connector, be careful to avoid bending the coax center conductor.

Most other intercircuit connections are made through pin connectors to the Interconnect board (A13). Some pin connectors on the Interconnect board are leads of feedthrough capacitors.

All connectors are identified on the schematic and board with "P" numbers.

Resistors. Composition (brown body), metal-film (gray or light blue body), and chip resistors are used in this instrument. The resistance values of composition and metal-film resistors are color coded on the component with EIA color code (some metal film resistors may have the value printed on the body). Chip resistors are generally too small to be marked, and therefore should be handled cautiously to avoid mixing resistors of different values if replacing more than one.

Capacitors. The capacitance value of common disc capacitors or small electrolytics are marked in microfarads or picofarads on the side of the component body. The white ceramic capacitors and tantalum electrolytics are color coded. Chip capacitors are generally too small to be marked, and so again, care should be taken against mixing more than one value of chip component at a time.

Diodes. The cathode of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. Some diodes have a diode symbol printed on one side.

Most diodes can be checked in the circuit by taking measurements across the diode and comparing these with voltages listed on the diagram. Forward-to-back resistance ratios can usually be taken by referring to the schematic and pulling appropriate transistors and pin connectors to remove low resistance loops around the diode.

CAUTION

Do not use an ohmmeter scale with a high external current to check the diode junction.

Transistors. Lead identification for the transistors and ICs is shown in Fig. 5-4.

Semiconductor failures account for the majority of electronic equipment failures. Substitution is often the most practical means for checking their performance. The following duidelines should be followed when substituting these components:

a. First determine that circuit voltages are safe for the substituted component, so the replacement will not be damaged.

b. Use only good components for substitution.

c. Turn the power off before a component is substituted.

d. Be sure the component is inserted properly in its socket (see Fig. 5-4 or the manufacturer's data sheet).

e. After the operational check, return the good components to their original sockets to reduce calibration time and burn-in period.

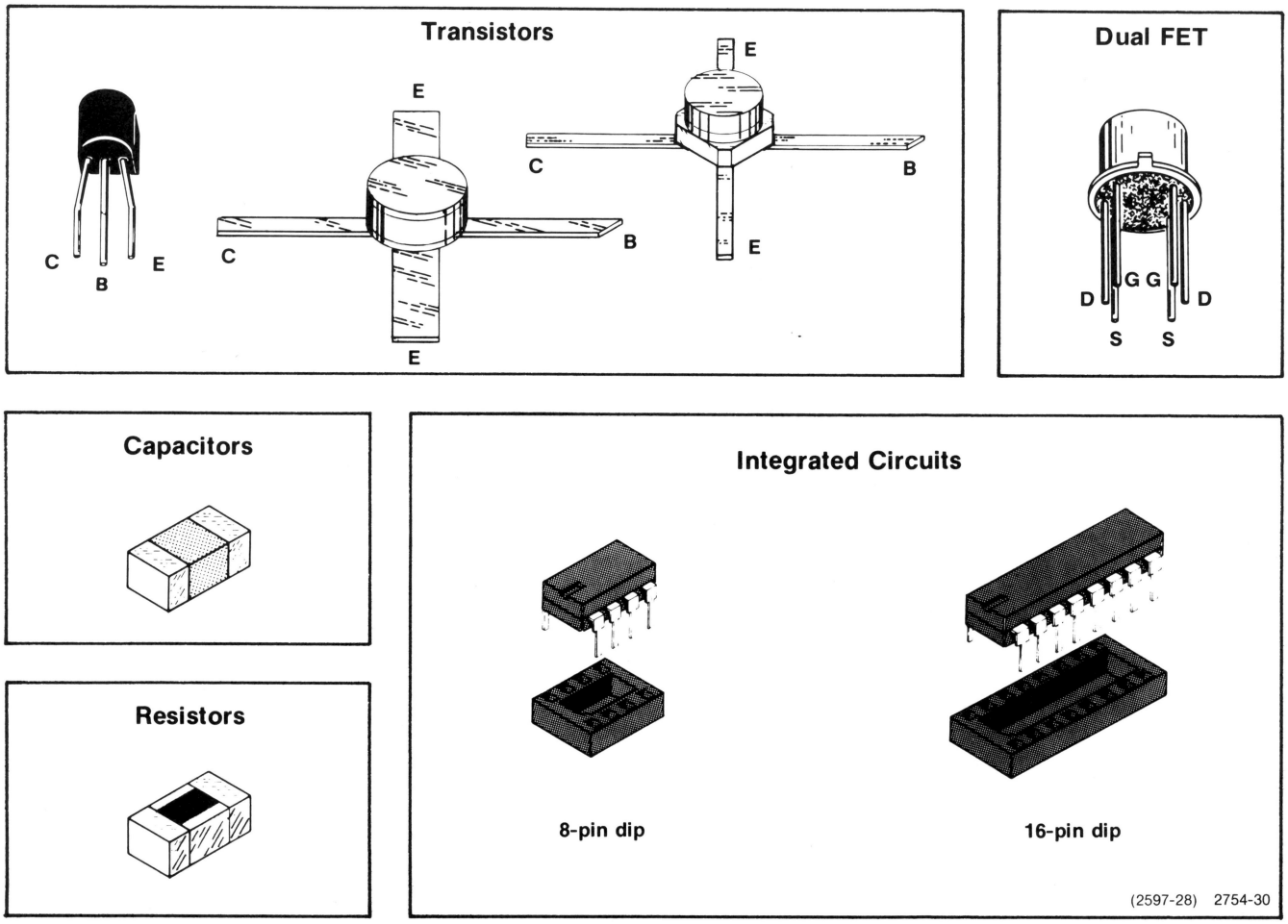


Fig. 5-4. Active component basing diagram.

NOTE

If a substitute is not available, check the transistor with a dynamic tester such as the TEKTRONIX 577 Curve Tracer. Static-type testers, such as an ohmmeter, can be used to check the resistance ratio across some semiconductor junctions if no other method is available. Use the high resistance ranges (R X 1k or higher) so that the external test current is limited to less than 6 mA. If uncertain, measure the external test current with an ammeter. Resistance ratios across base-to-emitter or base-to-collector junctions usually run 100:1 or higher. The ratio is measured by connecting the meter leads across the terminals, noting the reading, then reversing the leads and noting the second reading.

Integrated Circuits (IC). Integrated circuits are most easily checked by direct replacement. When substitution is impossible, check input and output signal states as described in the circuit description and on the diagram. Lead configurations for the IC used in this instrument are provided on the inside fold of the schematic or the back of the previous schematic.

Check calibration and performance after a faulty component has been replaced.

If the above procedure fails to locate the trouble, a more detailed analysis must be performed. The Circuit Description section describes the operational theory of each circuit, and may aid to further evaluate the problem.

GENERAL TROUBLESHOOTING TECHNIQUE

The following procedure is recommended to isolate a problem and expedite repairs.

1. Ensure that the malfunction exists in the instrument. Check the operation of associated equipment and the operating procedure of the instrument (see Operating Instructions).

2. Determine and evaluate all trouble symptoms. Try to isolate the problem to a circuit or assembly. The block diagram in the Diagrams section can aid in signal tracing and circuit isolation. The circuit boards are generally connected by coax cables, so the stages can be checked stage by stage. A spectrum analyzer and tracking generator are convenient tools for these checks.

CAUTION

When measuring voltages and waveforms, use extreme care in placing meter leads or probes. Because of high component density and limited access within the instrument, an inadvertent movement of the leads or probe could cause a short circuit. This may produce transient voltages that can destroy many components.

3. Make an educated guess as to the nature of the problem, such as component failure or calibration, and the functional area most likely at fault.

4. Visually inspect the area or the assembly for such defects as broken or loose connections, improperly seated components, overheated or burned components, chafed insulation, etc. Use a magnifying glass or a jewelers eye loupe to inspect chip parts. Repair or replace all obvious defects. In the case of overheated components, try to determine the cause of the overheated condition and correct before reapplying power.

5. By successive electrical checks, locate the problem. At this time an oscilloscope and spectrum analyzer are valuable test items for evaluating circuit performance. If applicable, check the calibration adjustments. Before changing an adjustment, note its position so that it can be returned to the original setting. This will facilitate recalibration after the trouble has been located and repaired.

6. Determine the extent of the repair needed; if complex, we recommend contacting your local Tektronix Field Office or representative. If minor, such as a simple component replacement, see the replaceable parts lists for replacement information. Removal and replacement procedure of the assemblies is described under Corrective Maintenance.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques and procedures, required to replace components in this instrument, are described here.

Obtaining Replacement Parts

All electrical and mechanical parts are available through your local Tektronix Field Office or representative. The parts list section contains information on how to order these replacement parts. Many standard electronic components can be obtained locally in less time than that required to order from Tektronix, Inc. It is best to duplicate the original component as closely as possible. Parts orientation and lead dress should be duplicated because some components are oriented to reduce interaction or to control circuit characteristics.

If a part you have ordered has been replaced with a new or improved part, your local Field Office or representative will contact you concerning any change in the part number. After repair, the circuits may need recalibration.

Soldering Chip Components (See Fig. 5-5)

Many circuit boards in this instrument have chip components. The contacts on chip resistors and capacitors are usually plated with silver. These components should be soldered with a 3% silver-bearing solder (Tektronix Part No. 006-0064-00).

Remove excess solder from the circuit board pads before soldering so that the component will lie flat. If the first solder joint is made with the component at an angle, soldering the second joint will cause pressure to be applied to the first, possibly breaking it. Use solder wick or other solder removers to remove the excess solder and clean the surface.

CAUTION

Do not apply a soldering iron directly to the chip component contacts. This will burn the silver plating.

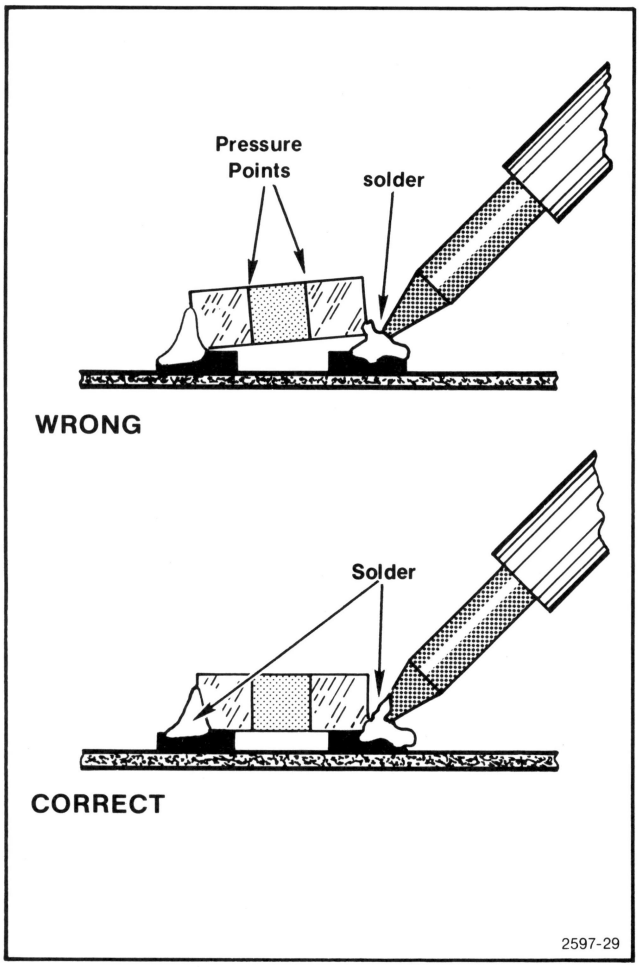


Fig. 5-5. Soldering chip components.

Parts Not Replaceable

There are several components and circuits in the TDC1/TDC2 that are not directly replaceable. We recommend that you contact your local Tektronix Field Office or representative concerning servicing of these parts.

PIN Driver and PIN Attenuators: New Programmable Read Only Memories (PROM) must be programmed if one of the old PROM or precision resistors on the PIN Driver board, or a PIN diode in the PIN Attenuator circuit needs to be replaced. Because each PROM program is unique, the PROM and PIN diodes are not directly replaceable. The affected boards are A2 and A12 in the TDC1 and TDC2. See the Replaceable Electrical Parts list for replacement information.

Indicator Board (A10): S76 on this board is made up of two parts: a set of contacts and a rocker arm. This switch requires a special fixture to mount on the board, and can be replaced only at a service center. Return the board, together with the defective switch, to your nearest Tektronix service center.

Torx Screws

This instrument uses self-tapping Torx head screws. A Torx screwdriver is supplied in the accessories kit for the 1450-1. Also, a tip for magnetic-tip or air-driven screwdrivers is available (Tektronix Part No. 003-0814-00).

Do not use more than about 8 to 10 inch-pounds of torque when tightening the Torx screws. If a screw head breaks off, leaving the screw body in the metal, the screw should be replaced using the following procedure:

1. Remove any other screws holding down the shield cover, and lift the cover off. This will expose part of the screw stud.

2. Use a pair of pliers or vise-grips to remove the screw.

3. Using a .109 (7/64)-inch drill bit, drill the hole about 0.5 inch deeper.

4. Replace the shield cover, and insert a 3 mm X 20 mm Torx screw (Tektronix Part No. 213-812-00).

Replacing Assemblies

The following procedures give detailed replacement information for those assemblies that require special instructions.

Removing the 1st LO Assembly (A8)

1. Remove the harmonica connector from the front-panel LED. This connector is located immediately behind the front panel. See Fig. 5-6.

2. Remove the if cable from the front-panel IF OUT connector.

3. Remove the nuts and washers from the RF IN, 1st LO, and 2nd LO connectors.

4. Remove the knob from the TUNING shaft.

5. Remove the two screws at the opposite ends of the front panel, and slide the front panel away from the down converter.

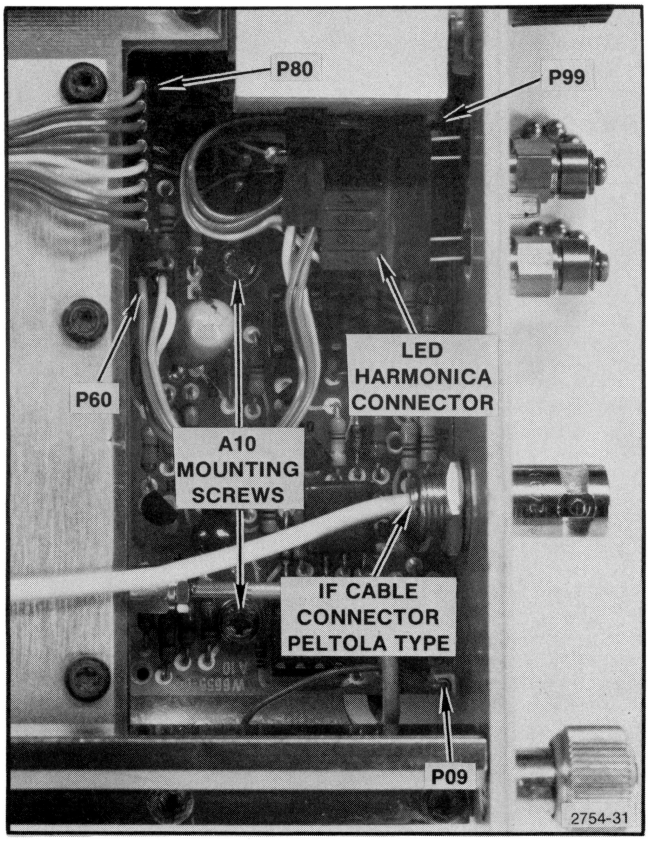


Fig. 5-6. Removing the 1st LO assembly and indicator board.

6. Disconnect all cables and wires from A8. See Fig. 5-7.

7. Turn the down converter over and remove the harmonica connector from the optocoupler (Q25) on A8.

8. Remove the four screws securing A8 to A13. Carefully lift the 1st LO assembly out of the down converter while tilting to clear A10.

To replace, reverse the procedure.

Removing the 1st IF Amp Board (A5) (See Fig. 5-8)

1. Remove the shield cover from over the compartment containing A5.

2. Disconnect P03 and P89. See Fig. 5-8.

3. Remove six screws from opposite edges of the board, three at each edge.

4. Carefully lift the board out until P30 is cleared, then tilt to clear cables from A4 and A6.

To replace, reverse the procedure.

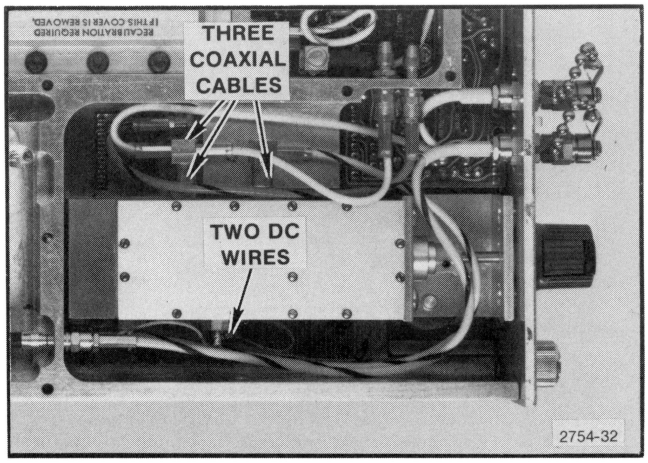


Fig. 5-7. Removing the 1st LO assembly.

Removing the 2nd Mixer (A7) (See Fig. 5-8)

1. Remove the cover from over the Interconnect board (A13).

2. Disconnect the cable at the position shown in Fig. 5-9.

3. Remove the nut and washer from this connector.

4. Turn the down converter over, and remove the shield cover from over the compartments containing A7 and A11.

5. Disconnect P17 and P77, and remove the three screws shown in Fig. 5-8.

6. Carefully lift the board out of the shield cavity while tilting it to clear the cable from A6.

To replace, reverse the procedure.

Removing the Indicator Board (A10) (See Fig. 5-6)

1. Remove the cover from over the Interconnect board (A13).

2. Disconnect P09, P60, P80, and P99 on A10.

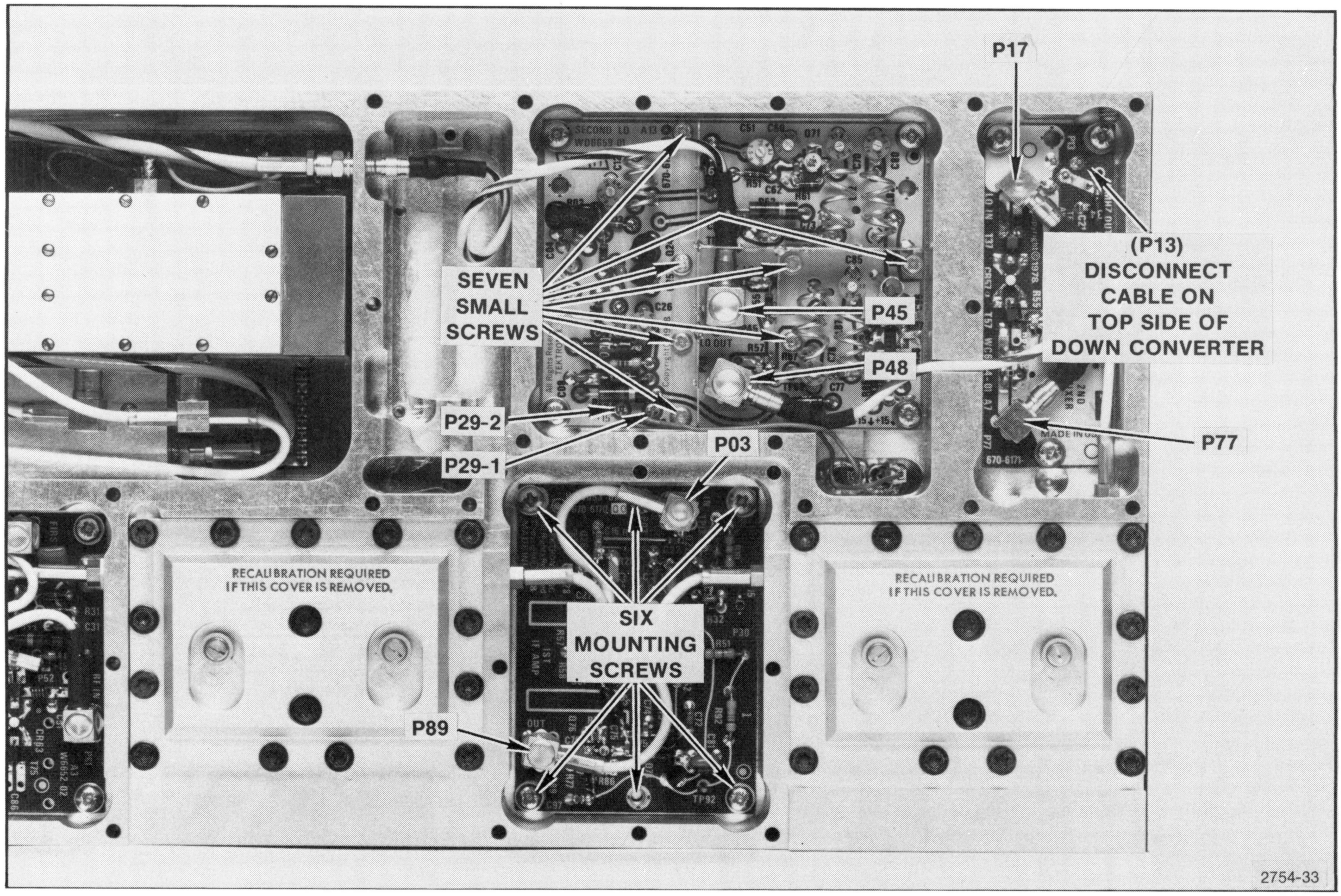


Fig. 5-8. Removing the 1st IF amp, 2nd LO, and 2nd mixer boards.

3. Remove the 1st LO assembly (A8). See the replacement procedure for A8.

4. Remove two mounting screws. See Fig. 5-6.

5. Slide A10 away from the down converter.

To replace, reverse the procedure.

Removing the 2nd LO Board (A11) (See Fig. 5-8)

1. Remove the shield cover from over the compartments containing A7 and A11.

2. Disconnect P45, P48, P29-1, and P29-2.

3. Remove four screws from the corners of the board, and remove seven smaller screws shown in Fig. 5-8.

4. Tilt and lift the board out of the shield cavity.

To replace, reverse the procedure.

Removing Helical Resonator Coils (See Fig. 5-9)

NOTE

We do not recommend replacing the helical resonator coils unless you are equipped to recalibrate the circuits involved. Study the Adjustment Procedure regarding these circuits to determine if you have the necessary equipment and experience to perform this recalibration. Contact your local Tektronix Field Office or representative concerning returning the instrument for repair.

1. Remove the shield cover from the compartment containing the helical resonator coil.

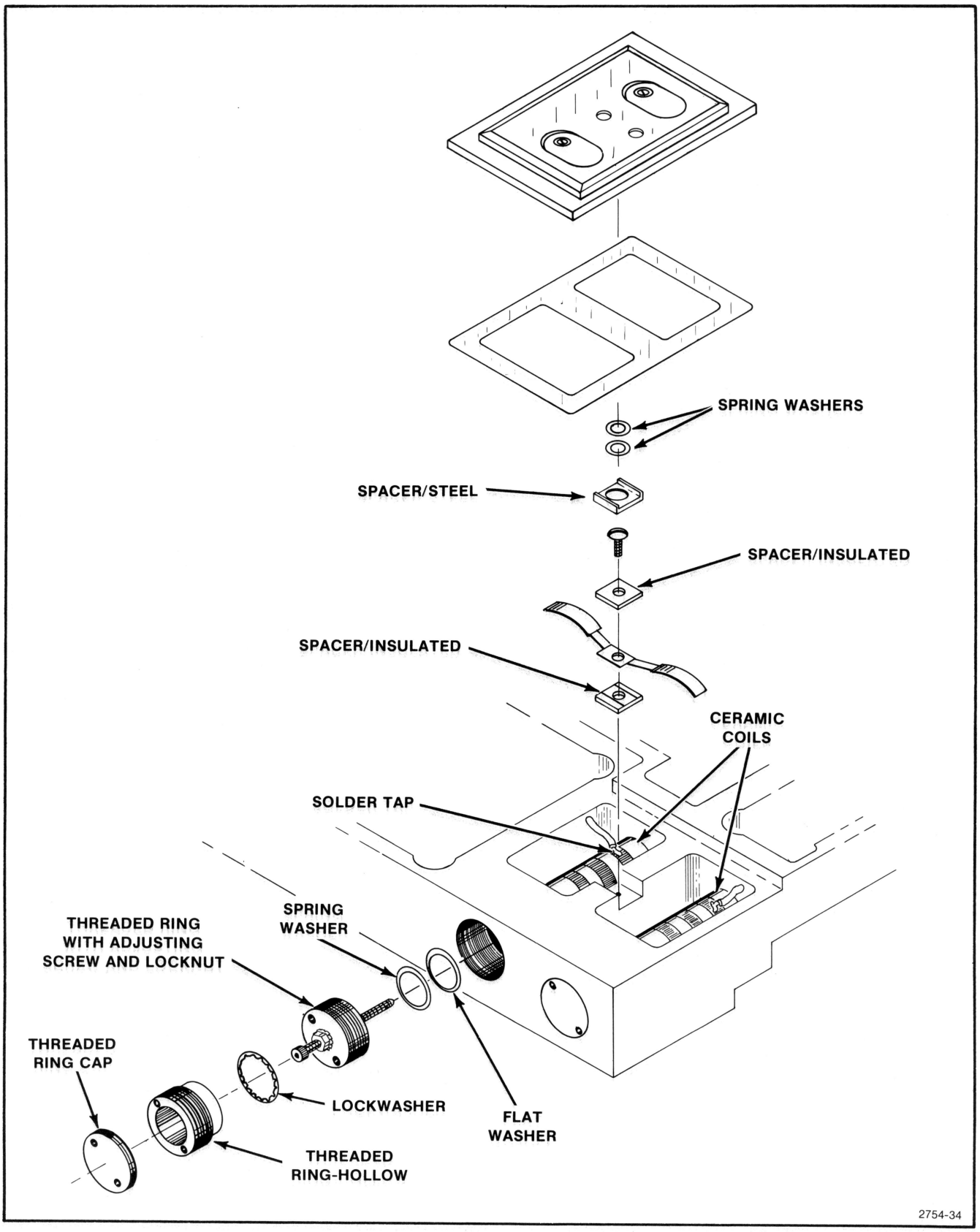


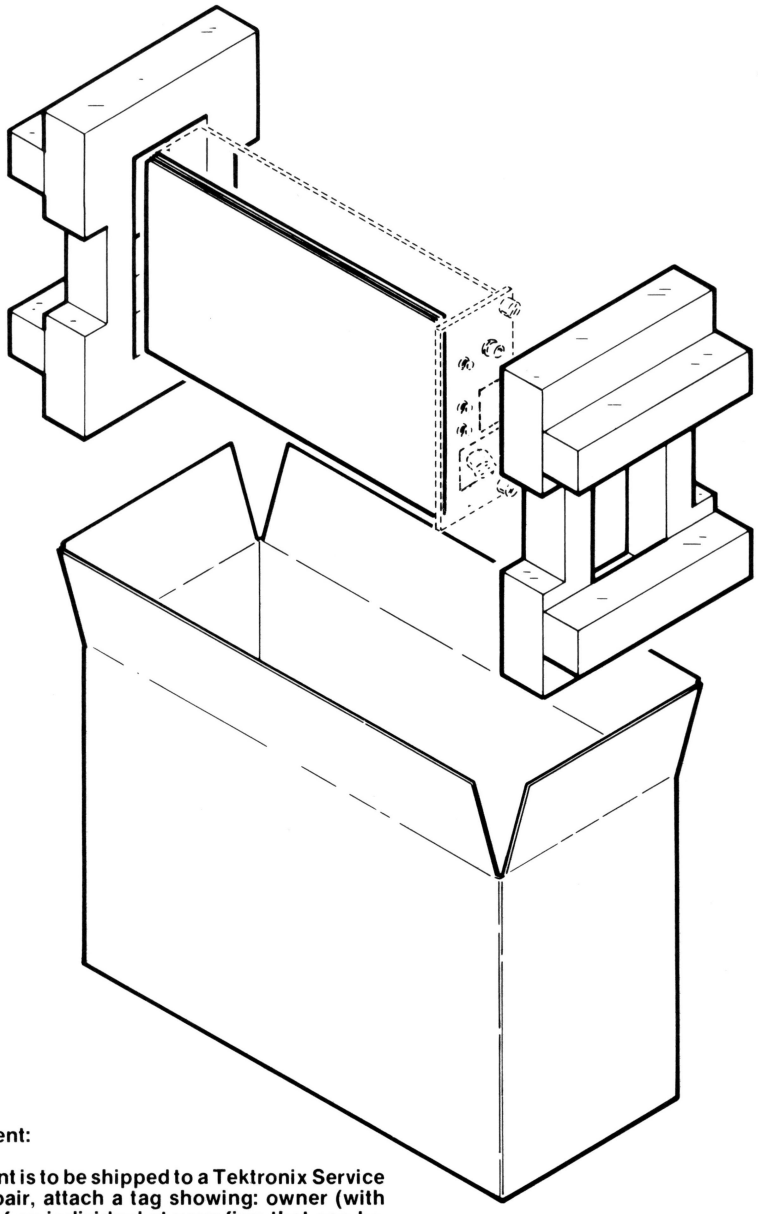
Fig. 5-9. Removing the helical resonator coils.

2. Remove the outer external threaded ring using an extracting tool (Tektronix Part No. 003-0842-00).

3. Remove the inner external threaded ring, supporting the coil form, to prevent it slipping and jamming against the ring.

4. Set the lockwasher aside, and remove the coil.

To replace, reverse the procedure.



Repackaging for Shipment:

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

1. Obtain a carton of corrugated cardboard having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Refer to Table 1 for carton test strength requirements.
2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.
4. Seal carton with shipping tape or industrial stapler.

Table 1
Shipping Carton Test Strength

Gross Weight (lb.)	Carton Test Strength (lb.)
0 — 10	200
10 — 30	275
30 — 120	375
120 — 140	500
140 — 160	600

(2597-36) 2754-35

Fig. 5-10. Repackaging instructions.

OPTIONS

As of this printing there are three catalog options for the TDC1 and TDC2. Each TDC1 and TDC2 is produced to meet the special requirements of if and channel frequencies for the individual users. This results in several possible versions of the TDC1/TDC2. This manual documents all currently available versions in the regular manual sections.

See Table 6-1 for the currently available options.

Table 6-1

TDC1 AND TDC2 OPTIONS

Option	2nd IF Frequency
1	37.0 MHz
2	38.9 MHz
3	45.75 MHz

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

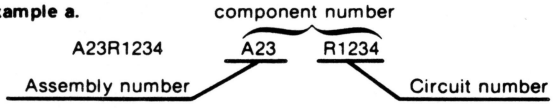
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

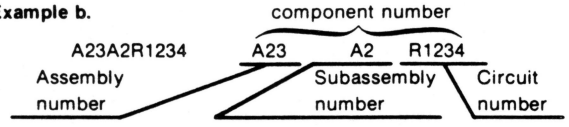
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

NAME & DESCRIPTION (column five of the Electrical Parts List)

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00853	SANGAMO WESTON INC COMPONENTS DIV	SANGAMO RD PO BOX 128	PICKENS SC 29671-9716
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
03888	KDI ELECTRONICS	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05464	INDUSTRIAL ELECTRONIC ENGINEERS INC	7440 LEMONA AVE	VAN NUYS CA 91405-1136
07263	FAIRCHILD SEMICONDUCTOR CORP		
07716	TRW INC TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
19396	ILLINOIS TOOL WORKS INC PAKTRON DIV	1205 MCCONVILLE RD PO BOX 4539	LYNCHBURG VA 24502-4535
19701	PHILIPS COMPONENTS DISCRETE PRODUCTS DIV RESISTIVE PRODUCTS FACILITY AIRPORT ROAD	PO BOX 760	MINERAL WELLS TX 76067-0760
21847	FEI MICROWAVE INC	825 STEWART DR	SUNNYVALE CA 94086-4514
27851	FILM MICROELECTRONICS INC	17 A ST	BURLINGTON MA 01803-3404
2M627	ROHM CORPORATION	PO BOX 19515	IRVINE CA 92713
32694	OPTEK TECHNOLOGY INC	1215 W CROSBY RD	CARROLLTON TX 75006
33096	COLORADO CRYSTAL CORP	2303 W 8TH ST	LOVELAND CO 80537-5268
34630	K AND L/QUARTZTEK INC	3940 W MONTECITO	PHOENIX AZ 85019
50101	FREQUENCY SOURCES INC SEMICONDUCTOR DIV SUB OF LORAL CORP	16 MAPLE RD	CHELMSFORD MA 01824-3737
50852	MELSEY CORP	202 CARLE RD	CARLE PLACE LI NY 11514-1714
51406	MURATA ERIE NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
51642	CENTRE ENGINEERING INC	2820 E COLLEGE AVE	STATE COLLEGE PA 16801-7515
52262	MICROPLEX INC	2126 S LYON ST	SANTA ANA CA 92705-5304
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
58361	QUALITY TECHNOLOGIES CORP	3400 HILLVIEW AVE	PALO ALTO CA 94304-1319
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
71279	INTERCONNECTION PRODUCTS INC	2601 S GARNSEY ST	SANTA ANA CA 92707-3338
71744	CHICAGO MINIATURE LAMP INC	CHEVY CHASE BUSINESS PARK 1080 JOHNSON DRIVE	BUFFALO GROVE IL 60089
72982	ERIE SPECIALTY PRODUCTS INC	645 W 11TH ST	ERIE PA 16512
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
91293	JOHANSON MFG CO	400 ROCKWAY VALLEY RD	BOONTON NJ 07005
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
S0545	NIPPON ELECTRIC CO LTD		TOKYO JAPAN
TK0858	STAUFFER SUPPLY CO (DIST)		
TK0961	NEC ELECTRONICS USA INC		
TK1345	ZMAN & ASSOCIATES		
TK1375	ESAM	PO BOX 376	GRANTS PASS OR 97526
TK1727	PHILIPS NEDERLAND BV AFD ELONCO	POSTBUS 90050	5600 PB EINDHOVEN THE NETHERLANDS
TK2042	ZMAN & ASSOCIATES	7633 S 180TH	KENT WA 98032

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2	----- -----			CKT BOARD ASSY:PIN ATTENUATOR (PART OF 672-0805-XX,TDC1 ONLY) CKT BOARD ASSY:PIN ATTENUATOR (PART OF 672-0806-00,TDC2 ONLY)		
A3	670-6169-00			CIRCUIT BD ASSY:FIRST MIXER (TDC1 ONLY)	80009	670-6169-00
A3	670-6169-01			CIRCUIT BD ASSY:FIRST MIXER (TDC2 ONLY)	80009	670-6169-01
A4	----- -----			BAND PASS FILTER		
A5	670-6170-00	B010100	B010527	CIRCUIT BD ASSY:IF AMP	80009	670-6170-00
A5	670-6170-01	B010528		CIRCUIT BD ASSY:IF AMP (TDC1 ONLY)	80009	670-6170-01
A5	670-6170-00	B010100	B010362	CIRCUIT BD ASSY:IF AMP	80009	670-6170-00
A5	670-6170-01	B010363		CIRCUIT BD ASSY:IF AMP (TDC2 ONLY)	80009	670-6170-01
A6	----- -----			BAND PASS FILTER		
A7	670-6171-00			CIRCUIT BD ASSY:SECOND MIXER	80009	670-6171-00
A8	119-1152-00			OSCILLATOR,RF:UHF,912-1326MHZ (TDC2 ONLY)	50852	ORDER BY DESCR
A8	119-1153-00			OSCILLATOR,RF:VHF,492-732MHZ (TDC1 ONLY)	50852	ORDER BY DESCR
A9	670-6166-00	B010100	B010376	CIRCUIT BD ASSY:PHASE LOCK	80009	670-6166-00
A9	670-6166-07	B010377		CIRCUIT BD ASSY:PHASE LOCK (TDC1 ONLY)	80009	670-6166-07
A9	670-6166-01	B010100	B010376	CIRCUIT BD ASSY:PHASE LOCK	80009	670-6166-01
A9	670-6166-08	B010377		CIRCUIT BD ASSY:PHASE LOCK (TDC2 ONLY)	80009	670-6166-08
A9	670-6166-02			CIRCUIT BD ASSY:PHASE LOCK (TDC1 OPTION 11 ONLY)	80009	670-6166-02
A10	670-6172-00	B010100	B010636	CIRCUIT BD ASSY:INDICATOR	80009	670-6172-00
A10	670-6172-02	B010637		CIRCUIT BD ASSY:INDICATOR (TDC1 ONLY)	80009	670-6172-02
A10	670-6172-01			CIRCUIT BD ASSY:UHF INDICATOR (TDC2 ONLY)	80009	670-6172-01
A11	670-6176-01	B010100	B010574	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-01
A11	670-6176-10	B010575		CIRCUIT BD ASSY:SECOND LO (TDC1 ONLY)	80009	670-6176-10
A11	670-6176-02	B010100	B010574	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-02
A11	670-6176-11	B010575		CIRCUIT BD ASSY:SECOND LO (TDC1 ONLY)	80009	670-6176-11
A11	670-6176-03	B010100	B010574	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-03
A11	670-6176-12	B010575		CIRCUIT BD ASSY:SECOND LO (TDC1 ONLY)	80009	670-6176-12
A11	670-6176-04	B010100	B010407	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-04
A11	670-6176-13	B010408		CIRCUIT BD ASSY:SECOND LO (TDC2 ONLY)	80009	670-6176-13
A11	670-6176-05	B010100	B010407	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-05
A11	670-6176-14	B010408		CIRCUIT BD ASSY:SECOND LO (TDC2 ONLY)	80009	670-6176-14
A12	----- -----			CKT BOARD ASSY:PIN DRIVER (PART OF 672-0805-XX VHF,TDC1 AND PART OF 670-0806-00 UHF,TDC2)		
A12	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A13	670-6175-00			CIRCUIT BD ASSY:INTFC (TDC1,TDC2)	80009	670-6175-00
A13	672-0805-00	B010100	B010199	CIRCUIT BD ASSY:VHF/PIN ATTENUATOR (TDC1 ONLY)	80009	672-0805-00
A13	672-0805-02	B010200		CIRCUIT BD ASSY:VHF/PIN ATTENUATOR (TDC1 ONLY)	80009	672-0805-02
A13	672-0806-00			CIRCUIT BD ASSY:UHF/PIN ATTENUATOR (TDC2 ONLY)	80009	672-0806-00
A2	----- -----			CKT BOARD ASSY:PIN ATTENUATOR		

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
				(PART OF 672-0805-XX,TDC1 ONLY) CKT BOARD ASSY:PIN ATTENUATOR (PART OF 672-0806-00,TDC2 ONLY)		
A2C8	283-0407-00			CAP,FXD,CER DI:27PF,5%,50V (TDC2 ONLY)	04222	ULA105A270J8
A2C17	281-0123-00			CAP,VAR,CER DI:5-25PF,100V (TDC1 ONLY)	59660	518-000A5-25
A2C28	281-0151-00			CAP,VAR,CER DI:1-3PF,100V (TDC2 ONLY)	51406	DVJ5126
A2C34	281-0151-00			CAP,VAR,CER DI:1-3PF,100V (TDC2 ONLY)	51406	DVJ5126
A2C35	281-0158-01			CAP,VAR,CER DI:7-45 PF,100V (TDC1 ONLY)	59660	518-006G7-45
A2C36	281-0151-00			CAP,VAR,CER DI:1-3PF,100V (TDC2 ONLY)	51406	DVJ5126
A2C45	281-0158-01			CAP,VAR,CER DI:7-45 PF,100V (TDC1 ONLY)	59660	518-006G7-45
A2C48	281-0151-00			CAP,VAR,CER DI:1-3PF,100V (TDC2 ONLY)	51406	DVJ5126
A2C53	281-0151-00			CAP,VAR,CER DI:1-3PF,100V (TDC2 ONLY)	51406	DVJ5126
A2C54	281-0123-00			CAP,VAR,CER DI:5-25PF,100V (TDC1 ONLY)	59660	518-000A5-25
A2C54	283-0265-00			CAP,FXD,CER DI:3.35PF,+/-0.15PF,100V (TDC2 ONLY)	51642	UC02100NP0339BPS
A2C55	283-0315-00			CAP,FXD,CER DI:470PF,10%,100V (TDC1 ONLY)	80009	283-0315-00
A2C60	283-0252-00			CAP,FXD,CER DI:0.001UF,10%,50V	56289	
A2C66	283-0356-00			CAP,FXD,CER DI:220PF,20%,50V (TDC2 ONLY)	80009	283-0356-00
A2C67	283-0315-00			CAP,FXD,CER DI:470PF,10%,100V (TDC1 ONLY)	80009	283-0315-00
A2C67	283-0356-00			CAP,FXD,CER DI:220PF,20%,50V (TDC2 ONLY)	80009	283-0356-00
A2C74	283-0252-00			CAP,FXD,CER DI:0.001UF,10%,50V	56289	
A2C76	283-0356-00			CAP,FXD,CER DI:220PF,20%,50V (TDC2 ONLY)	80009	283-0356-00
A2C80	283-0252-00			CAP,FXD,CER DI:0.001UF,10%,50V	56289	
A2C84	283-0252-00			CAP,FXD,CER DI:0.001UF,10%,50V	56289	
A2C86	283-0315-00			CAP,FXD,CER DI:470PF,10%,100V (TDC1 ONLY)	80009	283-0315-00
A2C86	283-0356-00			CAP,FXD,CER DI:220PF,20%,50V (TDC2 ONLY)	80009	283-0356-00
A2CR64	----- -----			(PART OF 672-0805-XX, TDC1 ONLY)		
A2CR66	----- -----			(PART OF 672-0805-XX,672-0806-00 ONLY)		
A2CR74	----- -----			(PART OF 672-0806-00, TDC2 ONLY)		
A2CR76	----- -----			(PART OF 672-0805-XX,672-0806-00 ONLY)		
A2L16	108-0985-00			COIL,RF:FIXED,30NH (TDC2 ONLY)	80009	108-0985-00
A2L24	108-0984-00			COIL,RF:FIXED,26NH (TDC2 ONLY)	80009	108-0984-00
A2L26	108-0988-00			COIL,RF:FIXED,59NH (TDC1 ONLY)	80009	108-0988-00
A2L35	108-0988-00			COIL,RF:FIXED,59NH (TDC1 ONLY)	80009	108-0988-00
A2L36	108-0983-00			COIL,RF:FIXED,76NH (TDC2 ONLY)	80009	108-0983-00
A2L44	108-0984-00			COIL,RF:FIXED,26NH (TDC2 ONLY)	80009	108-0984-00
A2L45	108-0988-00			COIL,RF:FIXED,59NH (TDC1 ONLY)	80009	108-0988-00
A2L56	108-0984-00			COIL,RF:FIXED,26NH	80009	108-0984-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
				(TDC2 ONLY)		
A2L66	108-0436-00	B010100	B010119	COIL,RF:FIXED,240UH ON FORM	80009	108-0436-00
				(TDC1 ONLY)		
A2L66	108-0262-00	B010200		COIL,RF:FIXED,505NH	80009	108-0262-00
				(TDC1 ONLY)		
A2L73	108-0896-00			COIL,RF:FIXED,30 MH	80009	108-0896-00
				(TDC1 ONLY)		
A2L73	108-0262-00			COIL,RF:FIXED,505NH	80009	108-0262-00
				(TDC2 ONLY)		
A2L74	276-0569-00			CORE,EM:TOROID,FERRITE	80009	276-0569-00
				(TDC2 ONLY)		
A2L76	108-0215-00			COIL,RF:FIXED,1.1UH	TK1345	108-0215-00
A2L82	108-0262-00			COIL,RF:FIXED,505NH	80009	108-0262-00
				(TDC2 ONLY)		
A2L83	108-0896-00			COIL,RF:FIXED,30 MH	80009	108-0896-00
				(TDC1 ONLY)		
A2L84	276-0569-00			CORE,EM:TOROID,FERRITE	80009	276-0569-00
				(TDC2 ONLY)		
A3	670-6169-00			CIRCUIT BD ASSY:FIRST MIXER	80009	670-6169-00
				(TDC1 ONLY)		
A3	670-6169-01			CIRCUIT BD ASSY:FIRST MIXER	80009	670-6169-01
				(TDC2 ONLY)		
A3C15	283-0321-00			CAP,FXD,CER DI:1.8PF,0.25PF,50V	80009	283-0321-00
A3C17	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A3C22	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A3C23	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A3C24	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A3C25	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A3C26	283-0254-00			CAP,FXD,CER DI:7PF,+/-7.5%,100V	51642	UC01 (ADVISE)
A3C28	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A3C31	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A3C47	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A3C51	283-0415-00			CAP,FXD,CER DI:4.7PF,0.5PF,100V	04222	10051A4R7DAT050L
				(TDC1 ONLY)		
A3C51	283-0321-00			CAP,FXD,CER DI:1.8PF,0.25PF,50V	80009	283-0321-00
				(TDC2 ONLY)		
A3C52	283-0337-00			CAP,FXD,CER DI:10PF,10%,100V	04222	1005-1A100K2
				(TDC2 ONLY)		
A3C53	283-0321-00			CAP,FXD,CER DI:1.8PF,0.25PF,50V	80009	283-0321-00
A3C85	283-0310-00			CAP,FXD,CER DI:2.5PF,+/-0.25PF,100V	80009	283-0310-00
A3C86	283-0254-00			CAP,FXD,CER DI:7PF,+/-7.5%,100V	51642	UC01 (ADVISE)
A3C88	281-0151-00			CAP,VAR,CER DI:1-3PF,100V	51406	DVJ5126
A3CR63	152-0715-00			SEMICOND DVC,DI:SCHOTTKY,SI,RING QUAD,M491G	80009	152-0715-00
A3L46	108-0983-00			COIL,RF:FIXED,76NH	80009	108-0983-00
A3L51	108-0984-00			COIL,RF:FIXED,26NH	80009	108-0984-00
				(TDC2 ONLY)		
A3L52	108-0985-00			COIL,RF:FIXED,30NH	80009	108-0985-00
				(TDC1 ONLY)		
A3L87	108-0984-00			COIL,RF:FIXED,26NH	80009	108-0984-00
A3L97	108-0643-00			COIL,RF:FIXED,54NH	80009	108-0643-00
A3Q27	151-0658-00			TRANSISTOR:NPN,SI	S0545	NE02103-D
A3Q34	151-0216-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0216-00
A3R22	317-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
A3R24	317-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.125W	80009	317-0332-00
A3R25	307-0570-00			RES,FXD,FILM:18 OHM,2%,0.12K W	52262	MCRA180FYZ
A3R26	307-0279-00			RES,FXD,FILM:10 OHM,10%,100 MW	03888	
A3R27	307-0569-00			RES,FXD,FILM:249 OHM,1%,0.125 W	52262	MCRA249R0FYZ
A3R31	317-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.125W	80009	317-0122-00
A3R41	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A3R42	301-0101-00			RES,FXD,FILM:100 OHM,5%,0.5W	01121	EB1015

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3R54	307-0276-00			RES,FXD,FILM:300 OHM,10%,100 MW	03888	
A3R55	307-0279-00			RES,FXD,FILM:10 OHM,10%,100 MW	03888	
A3R67	307-0514-00			RES,FXD,FILM:27 OHM,1%,0.075W	52262	MCRA270FYZ
A3T63	120-1153-00			TRANSFORMER,RF:BALUN	80009	120-1153-00
A3T75	120-1153-00			TRANSFORMER,RF:BALUN	80009	120-1153-00
A3TP23	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A3TP33	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A4	----- -----			BAND PASS FILTER		
A4C55	214-2559-00			TUNING DVC,COIL:2.3 L X 0.399 W,CU BE	80009	214-2559-00
A4C55	213-0787-00			SCREW,TUNING:0.234-64 X 0.36,DIELECTRIC	91293	6935-0
A4L52	108-0885-02			COIL,RF:FIXED,60NH	80009	108-0885-02
A4L57	108-0885-02			COIL,RF:FIXED,60NH	80009	108-0885-02
A5	670-6170-00	B010100	B010527	CIRCUIT BD ASSY:IF AMP	80009	670-6170-00
A5	670-6170-01	B010528		CIRCUIT BD ASSY:IF AMP (TDC1 ONLY)	80009	670-6170-01
A5	670-6170-00	B010100	B010362	CIRCUIT BD ASSY:IF AMP	80009	670-6170-00
A5	670-6170-01	B010363		CIRCUIT BD ASSY:IF AMP (TDC2 ONLY)	80009	670-6170-01
A5C16	283-0321-00			CAP,FXD,CER DI:1.8PF,0.25PF,50V	80009	283-0321-00
A5C22	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C23	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A5C24	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A5C26	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C27	283-0374-00			CAP,FXD,CER DI:7.5PF,0.25%,100V	91293	101R11N7R5CB
A5C32	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A5C34	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A5C43	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A5C44	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A5C46	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C56	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C57	283-0310-00			CAP,FXD,CER DI:2.5PF,+/-0.25PF,100V	80009	283-0310-00
A5C72	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A5C74	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C75	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C76	283-0415-00	B010100	B010108	CAP,FXD,CER DI:4.7PF,0.5PF,100V (TDC1 ONLY)	04222	10051A4R7DAT050L
A5C76	283-0140-00	B010109		CAP,FXD,CER DI:4.7PF,+/-0.25PF,50V (TDC1 ONLY)	72982	8101E003A479C
A5C76	283-0415-00	B010100	B010109	CAP,FXD,CER DI:4.7PF,0.5PF,100V (TDC2 ONLY)	04222	10051A4R7DAT050L
A5C76	283-0140-00	B010110		CAP,FXD,CER DI:4.7PF,+/-0.25PF,50V (TDC2 ONLY)	72982	8101E003A479C
A5C77	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5C81	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A5C82	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A5C86	283-0415-00	B010100	B010108	CAP,FXD,CER DI:4.7PF,0.5PF,100V (TDC1 ONLY)	04222	10051A4R7DAT050L
A5C86	283-0140-00	B010109		CAP,FXD,CER DI:4.7PF,+/-0.25PF,50V (TDC1 ONLY)	72982	8101E003A479C
A5C86	283-0415-00	B010100	B010109	CAP,FXD,CER DI:4.7PF,0.5PF,100V (TDC2 ONLY)	04222	10051A4R7DAT050L
A5C86	283-0140-00	B010110		CAP,FXD,CER DI:4.7PF,+/-0.25PF,50V (TDC2 ONLY)	72982	8101E003A479C
A5C97	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A5L36	108-0896-00			COIL,RF:FIXED,30 MH	80009	108-0896-00
A5L65	108-0444-00			COIL,RF:FIXED,15NH	80009	108-0444-00
A5L73	108-0896-00			COIL,RF:FIXED,30 MH	80009	108-0896-00
A5L77	108-0682-00			COIL,RF:FIXED,61NH	80009	108-0682-00
A5Q22	151-0216-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0216-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A5Q26	151-0630-00			TRANSISTOR:NPN,SI,4 LEAD,CER PKG	S0545	NE02135
A5Q42	151-0216-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0216-00
A5Q56	151-0630-00	670-6170-00	670-6170-00	TRANSISTOR:NPN,SI,4 LEAD,CER PKG	S0545	NE02135
A5Q56	151-0626-00	670-6170-01		TRANSISTOR:NPN,SI	TK0961	NE02107E
A5Q73	151-0216-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0216-00
A5Q76	151-0630-00	670-6170-00	670-6170-00	TRANSISTOR:NPN,SI,4 LEAD,CER PKG	S0545	NE02135
A5Q76	151-0626-00	670-6170-01		TRANSISTOR:NPN,SI	TK0961	NE02107E
A5R10	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315-0242-00
A5R11	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	80009	315-0302-00
A5R15	317-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.125W	80009	317-0332-00
A5R26	307-0657-00			RES,FXD,FILM:180 OHM,2%,0.125 W	27851	3MCS1800G
A5R27	307-0278-00			RES,FXD,FILM:20 OHM,5%,100 MW	52262	MCRA200JZ
A5R28	307-0278-00			RES,FXD,FILM:20 OHM,5%,100 MW	52262	MCRA200JZ
A5R32	315-0361-00			RES,FXD,FILM:360 OHM,5%,0.25W	80009	315-0361-00
A5R45	317-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.125W	80009	317-0332-00
A5R46	307-0657-00			RES,FXD,FILM:180 OHM,2%,0.125 W	27851	3MCS1800G
A5R47	307-0515-00			RES,FXD,FILM:510 OHM,1%,0.075W	52262	MCREC511FYZ
A5R51	315-0241-00			RES,FXD,FILM:240 OHM,5%,0.25W	80009	315-0241-00
A5R57	----- -----			(TEST SELECTABLE)		
A5R58	----- -----			(TEST SELECTABLE)		
A5R74	317-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.125W	80009	317-0332-00
A5R75	307-0571-00			RES,FXD,FILM:57 OHM,1%,0.125 W	52262	MCRA570FYZ
A5R76	307-0278-00			RES,FXD,FILM:20 OHM,5%,100 MW	52262	MCRA200JZ
A5R77	307-0336-00			RES,FXD,FILM:50 OHM,1%,0.105W	52262	MCRA 500 FYZ
A5R86	307-0278-00			RES,FXD,FILM:20 OHM,5%,100 MW	52262	MCRA200JZ
A5R92	315-0181-00	670-6170-00	670-6170-00	RES,FXD,FILM:180 OHM,5%,0.25W	80009	315-0181-00
A5R92	315-0271-00	670-6170-01		RES,FXD,FILM:270 OHM,5%,0.25W	80009	315-0271-00
A5TP12	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A5TP34	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A5TP52	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A5TP92	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A6	----- -----			BAND PASS FILTER		
A6C55	214-2559-00			TUNING DVC,COIL:2.3 L X 0.399 W,CU BE	80009	214-2559-00
A6C55	213-0787-00			SCREW,TUNING:0.234-64 X 0.36,DIELECTRIC	91293	6935-0
A6L52	108-0885-02			COIL,RF:FIXED,60NH	80009	108-0885-02
A6L57	108-0885-02			COIL,RF:FIXED,60NH	80009	108-0885-02
A7	670-6171-00			CIRCUIT BD ASSY:SECOND MIXER	80009	670-6171-00
A7C21	283-0411-00			CAP,FXD,CER DI:37PF,5%,100V	04222	10051A370JA2070
A7C31	283-0406-00			CAP,FXD,CER DI:75PF,5%,50V	04222	08055A750JAT050L
A7C41	283-0411-00			CAP,FXD,CER DI:37PF,5%,100V	04222	10051A370JA2070
A7CR57	152-0715-00			SEMICOND DVC,DI:SCHOTTKY,SI,RING QUAD,M491G	80009	152-0715-00
A7L21	108-0734-00			COIL,RF:FIXED,163NH	TK1345	108-0734-00
A7L41	108-0734-00			COIL,RF:FIXED,163NH	TK1345	108-0734-00
A7R52	307-0513-00			RES,FXD,FILM:120 OHM,1%,0.125W	52262	MCRA121FY
A7R53	311-1261-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80009	311-1261-00
A7R54	307-0279-00			RES,FXD,FILM:10 OHM,10%,100 MW	03888	
A7R55	307-0656-00			RES,FXD,FILM:430 OHM,2%,0.125 W	27851	3MC54300G
A7R67	307-0656-00			RES,FXD,FILM:430 OHM,2%,0.125 W	27851	3MC54300G
A7R68	307-0279-00			RES,FXD,FILM:10 OHM,10%,100 MW	03888	
A7R77	307-0656-00			RES,FXD,FILM:430 OHM,2%,0.125 W	27851	3MC54300G
A7T37	120-1153-00			TRANSFORMER,RF:BALUN	80009	120-1153-00
A7T57	120-1153-00			TRANSFORMER,RF:BALUN	80009	120-1153-00
A8	119-1152-00			OSCILLATOR,RF:UHF,912-1326MHZ (TDC2 ONLY)	50852	ORDER BY DESCR
A8	119-1153-00			OSCILLATOR,RF:VHF,492-732MHZ (TDC1 ONLY)	50852	ORDER BY DESCR
A9	670-6166-00	B010100	B010376	CIRCUIT BD ASSY:PHASE LOCK	80009	670-6166-00
A9	670-6166-07	B010377		CIRCUIT BD ASSY:PHASE LOCK (TDC1 ONLY)	80009	670-6166-07

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A9	670-6166-01	B010100	B010376	CIRCUIT BD ASSY:PHASE LOCK	80009	670-6166-01
A9	670-6166-08	B010377		CIRCUIT BD ASSY:PHASE LOCK (TDC2 ONLY)	80009	670-6166-08
A9	670-6166-02			CIRCUIT BD ASSY:PHASE LOCK (TDC1 OPTION 11 ONLY)	80009	670-6166-02
A9C3	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V (TDC1 OPTION 11 ONLY)	51406	RPE110Z5U103M50V
A9C6	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A9C32	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V (TDC1 OPTION 11 ONLY)	51406	RPE110Z5U103M50V
A9C34	283-0642-00			CAP,FXD,MICA DI:33PF,+/-0.5PF,500V (TDC1, TDC2)	00853	D105E330G0
A9C34	281-0158-01			CAP,VAR,CER DI:7-45 PF,100V (TDC1 OPTION 11 ONLY)	59660	518-006G7-45
A9C35	283-0642-00			CAP,FXD,MICA DI:33PF,+/-0.5PF,500V	00853	D105E330G0
A9C37	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A9C40	290-0574-00			CAP,FXD,ELCTLT:47UF,10%,20V	05397	T368C476K0202AS
A9C41	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	80009	283-0111-00
A9C42	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	80009	283-0111-00
A9C46	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A9C47	283-0314-00			CAP,FXD,CER DI:100PF,10%,100V	04222	08051A101KA2075
A9C49	283-0698-00			CAP,FXD,MICA DI:390PF,1%,500V	80009	283-0698-00
A9C52	290-0574-00			CAP,FXD,ELCTLT:47UF,10%,20V	05397	T368C476K0202AS
A9C57	283-0310-00			CAP,FXD,CER DI:2.5PF,+/-0.25PF,100V	80009	283-0310-00
A9C59	285-0651-01			CAP,FXD,PLASTIC:1700PF,5%,100V	80009	285-0651-01
A9C63	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A9C67	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A9C68	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A9C71	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A9C72	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	05397	C330C474M5U1CA
A9C79	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A9C82	283-0615-00	B010100	B010376	CAP,FXD,MICA DI:33PF,5%,500V	80009	283-0615-00
A9C82	283-0634-00	B010377		CAP,FXD,MICA DI:65PF,1%,100V	80009	283-0634-00
A9C86	285-1100-00			CAP,FXD,PLASTIC:0.022UF,5%,200V	19396	223J02PT485
A9C93	285-1067-00			CAP,FXD,PLASTIC:0.5UF,1%,200V	80009	285-1067-00
A9CR32	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35 (TDC1 OPTION 11 ONLY)	80009	152-0141-02
A9CR36	152-0335-01			SEMICOND DVC,DI:SRD,SI,35V,1PF,DO-35	50101	GC20279
A9CR37	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A9CR56	152-0723-00			SEMICOND DVC,DI:SCHOTTKY,SI,6V,0.45PF,DO-35	21847	A2X1518
A9CR57	152-0723-00			SEMICOND DVC,DI:SCHOTTKY,SI,6V,0.45PF,DO-35	21847	A2X1518
A9CR93	152-0141-02	B010102		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A9CR96	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A9CR97	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A9L31	108-0509-00			COIL,RF:FIXED,2.45UH	TK2042	ORDER BY DESCR
A9L52	108-0509-00			COIL,RF:FIXED,2.45UH	TK2042	ORDER BY DESCR
A9L67	108-0896-00			COIL,RF:FIXED,30 MH	80009	108-0896-00
A9Q37	151-0472-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0472-00
A9Q76	151-1054-00	B010100	B010232	TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1054-00
A9Q76	151-1054-02	B010233	B010376	TRANSISTOR:SCREEMED	04713	SFD1054-2
A9Q76	151-1054-00	B010377		TRANSISTOR:FET,N-CHAN,SI,TO-71 (TDC1 OPTION 11 ONLY)	80009	151-1054-00
A9Q76	151-1054-00	B010100	B010172	TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1054-00
A9Q76	151-1054-02	B010173	B010376	TRANSISTOR:SCREEMED	04713	SFD1054-2
A9Q76	151-1054-00	B010377		TRANSISTOR:FET,N-CHAN,SI,TO-71 (TDC2 ONLY)	80009	151-1054-00
A9R3	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W (TDC1 OPTION 11 ONLY)	80009	315-0102-00
A9R6	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A9R31	315-0390-00	B010100	B010101	RES,FXD,FILM:39 OHM,5%,0.25W	80009	315-0390-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A9R31	315-0150-00	B010102		RES,FXD,FILM:15 OHM,5%,0.25W	80009	315-0150-00
A9R33	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W (TDC1 OPTION 11 ONLY)	80009	315-0103-00
A9R34	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A9R36	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A9R39	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	80009	315-0510-00
A9R42	315-0750-00	B010100	B010101	RES,FXD,FILM:75 OHM,5%,0.25W	80009	315-0750-00
A9R42	315-0330-00	B010102		RES,FXD,FILM:33 OHM,5%,0.25W	80009	315-0330-00
A9R44	301-0151-00			RES,FXD,FILM:150 OHM,5%,0.5W	TK1727	SFR30 2322-182
A9R45	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A9R46	317-0510-00			RES,FXD,CMPSN:51 OHM,5%,0.125W	80009	317-0510-00
A9R53	315-0514-00			RES,FXD,FILM:510K OHM,5%,0.25W	2M627	NTR25J-E510K
A9R54	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	80009	315-0332-00
A9R57	307-0705-00			RES,FXD,FILM:24 OHM,2%,0.125 (NOMINAL VALUE, SELECTED)	80009	307-0705-00
A9R58	307-0521-00			RES,FXD,FILM:1.11M OHM,1%,0.125W	52262	MCRA1114FYZ
A9R62	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80009	311-1268-00
A9R63	311-1265-00			RES,VAR,NONWW:TRMR,2K OHM,0.5W	80009	311-1265-00
A9R64	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	80009	315-0512-00
A9R65	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	80009	315-0512-00
A9R69	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	80009	315-0201-00
A9R71	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	80009	315-0223-00
A9R73	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	80009	315-0223-00
A9R75	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A9R77	307-0656-00			RES,FXD,FILM:430 OHM,2%,0.125 W	27851	3MC54300G
A9R78	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	80009	315-0511-00
A9R80	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	80009	315-0151-00
A9R83	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	80009	315-0223-00
A9R84	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	80009	315-0203-00
A9R86	311-1263-00			RES,VAR,NONWW:1K OHM,10%,0.50W	80009	311-1263-00
A9R93	315-0103-00	B010102		RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00
A9R96	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	80009	315-0513-00
A9R97	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	80009	315-0104-00
A9T47	120-1261-00			TRANSFORMER,RF:	80009	120-1261-00
A9T57	120-1260-00			TRANSFORMER,RF:BALUN	80009	120-1260-00
A9TP38	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A9TP73	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A9TP85	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A9TP90	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A9U62	156-0742-00			MICROCKT,LINEAR:OPNL AMPL	01295	LM318P
A9U82	156-0105-00	B010100	B010229	MICROCKT,LINEAR:OPNL AMPL (TDC1 ONLY)	TK0961	MICROPC301AC
A9U82	156-0105-02	B010230		MICROCKT,LINEAR:OPNL AMPL,SELECTED (TDC1 ONLY)	80009	156-0105-02
A9U82	156-0105-00	B010100	B010177	MICROCKT,LINEAR:OPNL AMPL (TDC2 ONLY)	TK0961	MICROPC301AC
A9U82	156-0105-02	B010178		MICROCKT,LINEAR:OPNL AMPL,SELECTED (TDC2 ONLY)	80009	156-0105-02
A9VR94	152-0055-00			SEMICOND DVC,DI:ZEN,SI,11V,5%,0.4W,DO-7	14433	Z5407
A9Y2	158-0187-00			XTAL UNIT,QTZ:5.977MHZ,0.005%,PARALLEL (TDC1 OPTION 11 ONLY)	33096	CCAT101290
A9Y7	158-0186-00			XTAL UNIT,QTZ:6MHZ,0.005%,PARALLEL	34630	150-5130-6
A10	670-6172-00	B010100	B010636	CIRCUIT BD ASSY:INDICATOR	80009	670-6172-00
A10	670-6172-02	B010637		CIRCUIT BD ASSY:INDICATOR (TDC1 ONLY)	80009	670-6172-02
A10	670-6172-01			CIRCUIT BD ASSY:UHF INDICATOR (TDC2 ONLY)	80009	670-6172-01
A10C8	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A10C17	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
				(TDC1 ONLY)		
A10C23	290-0722-00			CAP,FXD,ELCTLT:100 UF,20%,10V	80009	290-0722-00
A10C27	283-0164-00			CAP,FXD,CER DI:2.2UF,20%,25V (TDC1 ONLY)	05397	C340C225M5UICA
A10C50	283-0100-00			CAP,FXD,CER DI:0.0047UF,10%,200V (TDC1 ONLY)	04222	SR302A472KAA
A10C51	290-0724-00			CAP,FXD,ELCTLT:330UF,20%,6V	56289	196D337X0006TE3
A10CR24	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35 (TDC1 ONLY)	80009	152-0141-02
A10CR25	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35 (TDC1 ONLY)	80009	152-0141-02
A10CR26	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35 (TDC1 ONLY)	80009	152-0141-02
A10CR27	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35 (TDC1 ONLY)	80009	152-0141-02
A10CR46	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35 (TDC1 ONLY)	80009	152-0141-02
A10CR52	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A10CR53	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A10DS76	150-0109-00			LAMP,INCAND:18V,0.026A,#CM7220,WIRE LD	71744	CM7220
A10Q21	151-0190-00			TRANSISTOR:NPN,SI,TO-92 (TDC1 ONLY)	80009	151-0190-00
A10Q23	151-0188-00			TRANSISTOR:PNP,SI,TO-92 (TDC1 ONLY)	80009	151-0188-00
A10Q25	156-1217-00	670-6172-02		MICROCKT,LINEAR:OPTOELECTRONIC ISOLATOR (TDC1 ONLY)	32694	OPB706A
A10Q28	151-0190-00			TRANSISTOR:NPN,SI,TO-92 (TDC1 ONLY)	80009	151-0190-00
A10Q35	151-0190-00			TRANSISTOR:NPN,SI,TO-92 (TDC1 ONLY)	80009	151-0190-00
A10Q45	151-0188-00			TRANSISTOR:PNP,SI,TO-92 (TDC1 ONLY)	80009	151-0188-00
A10Q96	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A10Q97	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A10R1	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0104-00
A10R7	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0104-00
A10R10	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0512-00
A10R12	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0104-00
A10R13	315-0123-00			RES,FXD,FILM:12K OHM,5%,0.25W	80009	315-0123-00
A10R17	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0513-00
A10R18	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0103-00
A10R19	315-0133-00			RES,FXD,FILM:13K OHM,5%,0.25W	80009	315-0133-00
A10R25	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0102-00
A10R30	315-0131-00	670-6172-00	670-6172-00	RES,FXD,FILM:130 OHM,5%,0.25W	80009	315-0131-00
A10R30	311-0634-00	670-6172-02		RES,VAR,NONWW:TRMR,500 OHM,0.5W (TDC1 ONLY)	80009	311-0634-00
A10R31	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0104-00
A10R32	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0302-00
A10R33	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0103-00
A10R34	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W (TDC1 ONLY)	80009	315-0102-00
A10R46	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	80009	315-0103-00

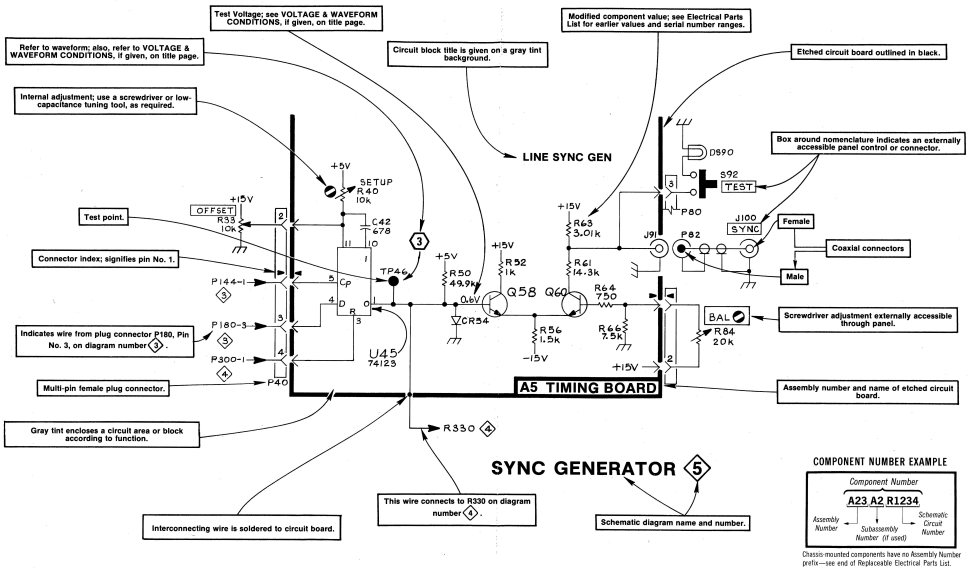
Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
				(TDC1 ONLY)		
A10R47	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	80009	315-0513-00
				(TDC1 ONLY)		
A10R48	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
				(TDC1 ONLY)		
A10R49	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
				(TDC1 ONLY)		
A10R50	315-0131-00	670-6172-02		RES,FXD,FILM:130 OHM,5%,0.25W	80009	315-0131-00
				(TDC1 ONLY)		
A10R53	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	80009	315-0622-00
A10R57	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	80009	315-0822-00
A10R67	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	80009	315-0242-00
A10R68	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A10R69	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	80009	315-0102-00
A10R71	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	80009	315-0200-00
A10R72	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	80009	315-0473-00
A10R85	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	80009	315-0201-00
A10R94	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	80009	315-0201-00
A10S76	366-1210-03			ACTR ASSY,PB:1 BUTTON	80009	366-1210-03
A10TP53	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A10TP68	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A10U5	156-0853-00			MICROCKT,LINEAR:OPNL AMPL,DUAL	80009	156-0853-00
				(TDC1 ONLY)		
A10U60	156-0853-00			MICROCKT,LINEAR:OPNL AMPL,DUAL	80009	156-0853-00
A11	670-6176-01	B010100	B010574	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-01
A11	670-6176-10	B010575		CIRCUIT BD ASSY:SECOND LO	80009	670-6176-10
				(TDC1 ONLY)		
A11	670-6176-02	B010100	B010574	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-02
A11	670-6176-11	B010575		CIRCUIT BD ASSY:SECOND LO	80009	670-6176-11
				(TDC1 ONLY)		
A11	670-6176-03	B010100	B010574	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-03
A11	670-6176-12	B010575		CIRCUIT BD ASSY:SECOND LO	80009	670-6176-12
				(TDC1 ONLY)		
A11	670-6176-04	B010100	B010407	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-04
A11	670-6176-13	B010408		CIRCUIT BD ASSY:SECOND LO	80009	670-6176-13
				(TDC2 ONLY)		
A11	670-6176-05	B010100	B010407	CIRCUIT BD ASSY:SECOND LO	80009	670-6176-05
A11	670-6176-14	B010408		CIRCUIT BD ASSY:SECOND LO	80009	670-6176-14
				(TDC2 ONLY)		
A11C3	283-0648-00			CAP,FXD,MICA DI:10PF,+/-0.5PF,500V	80009	283-0648-00
A11C4	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A11C8	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A11C12	281-0122-00			CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C14	283-0185-00	B010100	B020985	CAP,FXD,CER DI:2.5PF,0.5%,50V	51642	100-050-NPO-259B
A11C14	283-0185-01	B020986		CAP,FXD,CER DI:SLC;2.5PF,+/-0.1PF,50V,COJ,0 .15 X 0.15,RADIAL,BULK	59660	8111TXXXCOJ0259B
A11C16	283-0157-00			CAP,FXD,CER DI:7PF,5%,50V	04222	SR155A7R0DAA
A11C26	281-0122-00	B010100	B010574	CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C26	281-0151-00	B010575		CAP,VAR,CER DI:1-3PF,100V	51406	DVJ5126
				(TDC1 ONLY)		
A11C26	281-0122-00	B010100	B010407	CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C26	281-0151-00	B010408		CAP,VAR,CER DI:1-3PF,100V	51406	DVJ5126
				(TDC2 ONLY)		
A11C27	281-0612-00	B010575		CAP,FXD,CER DI:5.6PF,+/-0.5PF,500V	80009	281-0612-00
				(TDC1 ONLY)		
A11C27	281-0612-00	B010408		CAP,FXD,CER DI:5.6PF,+/-0.5PF,500V	80009	281-0612-00
				(TDC2 ONLY)		
A11C51	281-0122-00			CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C53	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	51406	RPE110Z5U103M50V
A11C60	281-0158-01			CAP,VAR,CER DI:7-45 PF,100V	59660	518-006G7-45
A11C62	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A11C70	281-0122-00			CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C73	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A11C77	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A11C78	281-0122-00			CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C80	281-0122-00			CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C85	281-0122-00			CAP,VAR,CER DI:2.5-9PF,100V	80009	281-0122-00
A11C86	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A11C96	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A11C97	283-0265-00			CAP,FXD,CER DI:3.35PF,+/-0.15PF,100V	51642	UC02100NP0339BPS
A11C98	283-0324-00			CAP,FXD,CER DI:0.01UF,+80-20%,50V	04222	08055C103ZA2055
A11CR96	152-0008-00			SEMICOND DVC,DI:SIG,GE,60V,60MA,A38A	14433	G1409
A11L17	108-0112-00			COIL,RF:FIXED,300NH	80009	108-0112-00
A11L21	108-0987-00			COIL,RF:FIXED,45NH	80009	108-0987-00
A11L28	108-0509-00			COIL,RF:FIXED,2.45UH	TK2042	ORDER BY DESCR
A11L41	108-0436-00			COIL,RF:FIXED,240UH ON FORM	80009	108-0436-00
A11L63	108-0509-00			COIL,RF:FIXED,2.45UH	TK2042	ORDER BY DESCR
A11L68	108-0509-00			COIL,RF:FIXED,2.45UH	TK2042	ORDER BY DESCR
A11L72	108-0986-00			COIL,RF:FIXED,30NH	80009	108-0986-00
A11L76	108-0986-00			COIL,RF:FIXED,30NH	80009	108-0986-00
A11L82	108-0989-00			COIL,RF:FIXED,40NH	80009	108-0989-00
A11L87	108-0989-00			COIL,RF:FIXED,40NH	80009	108-0989-00
A11P29	131-2415-00			TERMINAL,STUD:0.25 L W/O INSULATION	71279	140-1785-02-05
A11P45	131-1841-00			CONN,RCPT,ELEC:CKT BD,R ANGLE SNAP-ON	80009	131-1841-00
A11P48	131-1841-00			CONN,RCPT,ELEC:CKT BD,R ANGLE SNAP-ON	80009	131-1841-00
A11P95	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A11Q24	151-0472-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0472-00
A11Q25	151-0472-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0472-00
A11Q71	151-0658-00			TRANSISTOR:NPN,SI	S0545	NE02103-D
A11Q96	151-0658-00			TRANSISTOR:NPN,SI	S0545	NE02103-D
A11R2	317-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.125W	80009	317-0302-00
A11R13	317-0111-00			RES,FXD,CMPSN:110 OHM,5%,0.125W	80009	317-0111-00
A11R14	317-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.125W	80009	317-0302-00
A11R16	317-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.125W	80009	317-0302-00
A11R25	317-0101-00	B010575		RES,FXD,CMPSN:100 OHM,5%,0.125W (TDC1 ONLY)	80009	317-0101-00
A11R25	317-0101-00	B010408		RES,FXD,CMPSN:100 OHM,5%,0.125W (TDC2 ONLY)	80009	317-0101-00
A11R27	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	80009	315-0101-00
A11R28	301-0101-00			RES,FXD,FILM:100 OHM,5%,0.5W	01121	EB1015
A11R51	317-0561-00			RES,FXD,CMPSN:560 OHM,5%,0.125W	80009	317-0561-00
A11R52	301-0101-00			RES,FXD,FILM:100 OHM,5%,0.5W	01121	EB1015
A11R54	317-0510-00			RES,FXD,CMPSN:51 OHM,5%,0.125W	80009	317-0510-00
A11R55	317-0301-00			RES,FXD,CMPSN:300 OHM,5%,0.125W	80009	317-0301-00
A11R57	307-0279-00			RES,FXD,FILM:10 OHM,10%,100 MW	03888	
A11R58	307-0656-00			RES,FXD,FILM:430 OHM,2%,0.125 W	27851	3MC54300G
A11R61	317-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
A11R67	307-0656-00			RES,FXD,FILM:430 OHM,2%,0.125 W	27851	3MC54300G
A11R88	317-0102-00			RES,FXD,CMPSN:1K OHM,5%,0125W	80009	317-0102-00
A11R96	317-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
A11R97	317-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.125W	80009	317-0361-00
A11TP53	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A11TP68	214-0579-00			TERM,TEST POINT:BRS CD PL	TK0858	ORDER BY DESCR
A11Y5	158-0191-00			XTAL UNIT,QTZ:133.25MHZ,25PPM,SERIES (37.0 MHZ, TDC1 ONLY)	33096	CCAT707010
A11Y5	158-0189-00			XTAL UNIT,QTZ:133.95MHZ,25PPM,SERIES (38.9 MHZ, TDC2 ONLY)	33096	CCAT707008
A11Y5	158-0192-00			XTAL UNIT,QTZ:132.617MHZ,25PPM,SERIES (38.9 MHZ, TDC1 ONLY)	33096	CCAT707011
A11Y5	158-0193-00			XTAL UNIT,QTZ:131.667MHZ,25PPM,SERIES	33096	CCAT707012

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
				(45.7 MHZ, TDC2 ONLY)		
A11Y5	158-0194-00			XTAL UNIT,QTZ:130.333MHZ,0.0025%,SER	33096	PB 7013
				(45.75 MHZ, TDC1 ONLY)		
A11Y5	158-0190-00			XTAL UNIT,QTZ:134.583MHZ,25PPM,SERIES	33096	CCAT707009
				(37.0 MHZ, TDC2 ONLY)		
A12	----- -----			CKT BOARD ASSY:PIN DRIVER		
				(PART OF 672-0805-XX VHF,TDC1		
				AND PART OF 670-0806-00 UHF,TDC2)		
A12	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12C87	290-0573-00			CAP,FXD,ELCTLT:2.7UF,20%,50V	05397	T368B275M050AS
A12C88	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T368B226M015AS
A12CR17	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR21	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR22	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR27	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR28	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR31	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR32	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR37	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR38	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR41	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR47	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR51	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR52	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR57	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR58	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR61	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR62	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR67	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR68	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR71	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR77	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12CR81	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	80009	152-0141-02
A12Q10	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q19	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q20	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q21	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q28	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q29	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q30	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q31	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q38	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q39	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q40	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q48	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q50	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q51	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q58	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q59	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q60	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q61	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q68	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q69	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q70	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q79	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q80	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q81	151-0195-00			TRANSISTOR:SELECTED	80009	151-0195-00
A12Q88	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00
A12Q89	151-0219-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0219-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A12R2	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A12R12	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A12R17	315-0275-00			RES,FXD,FILM:2.7M OHM,5%,0.25W	01121	CB2755
A12R21	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A12R22	321-0816-07			RES,FXD,FILM:5K OHM,0.1%,0.125W,TC=T9	80009	321-0816-07
A12R27	315-0135-00			RES,FXD,FILM:1.3M OHM,5%,0.25W	80009	315-0135-00
A12R28	321-0463-00			RES,FXD,FILM:649K OHM,1%,0.125W	19701	5033YD649K0F
A12R31	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	80009	322-3289-00
A12R32	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A12R37	321-0434-00			RES,FXD,FILM:324K OHM,1%,0.125W,TC=T0	07716	CEAD32402F
A12R38	322-3405-00			RES,FXD,FILM:162K OHM,1%,0.2W,TC=T0	91637	CCF50-2F16202F
A12R41	321-0924-07			RES,FXD,FILM:40K OHM,0.1%,0.125W,TC=T9	80009	321-0924-07
A12R47	321-0376-00			RES,FXD,FILM:80.6K OHM,1%,0.125W,TC=T0	80009	321-0376-00
A12R51	321-0376-00			RES,FXD,FILM:80.6K OHM,1%,0.125W,TC=T0	80009	321-0376-00
A12R52	322-3405-00			RES,FXD,FILM:162K OHM,1%,0.2W,TC=T0	91637	CCF50-2F16202F
A12R57	321-0924-07			RES,FXD,FILM:40K OHM,0.1%,0.125W,TC=T9	80009	321-0924-07
A12R58	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A12R61	321-0424-00			RES,FXD,FILM:255K OHM,1%,0.125W,TC=T0	07716	CEAD25502F
A12R62	321-0463-00			RES,FXD,FILM:649K OHM,1%,0.125W	19701	5033YD649K0F
A12R67	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	80009	322-3289-00
A12R68	321-0816-07			RES,FXD,FILM:5K OHM,0.1%,0.125W,TC=T9	80009	321-0816-07
A12R71	315-0135-00			RES,FXD,FILM:1.3M OHM,5%,0.25W	80009	315-0135-00
A12R77	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A12R81	315-0275-00			RES,FXD,FILM:2.7M OHM,5%,0.25W	01121	CB2755
A12R82	315-0161-00			RES,FXD,FILM:160 OHM,5%,0.25W	19701	5043CX160R0J
A12R87	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A12R88	321-0929-07			RES,FXD,FILM:2.5K OHM,0.1%,0.125W,TC=T9	80009	321-0929-07
A12R92	322-3227-00			RES,FXD,FILM:2.26K OHM,1%,0.2W,TC=T0	91637	TO BE ASSIGNED
A12R93	322-3299-00			RES,FXD,FILM:12.7K OHM,1%,0.2W,TC=T0	80009	322-3299-00
A13	670-6175-00			CIRCUIT BD ASSY:INTFC (TDC1,TDC2)	80009	670-6175-00
A13	672-0805-00	B010100	B010199	CIRCUIT BD ASSY:VHF/PIN ATTENUATOR (TDC1 ONLY)	80009	672-0805-00
A13	672-0805-02	B010200		CIRCUIT BD ASSY:VHF/PIN ATTENUATOR (TDC1 ONLY)	80009	672-0805-02
A13	672-0806-00			CIRCUIT BD ASSY:UHF/PIN ATTENUATOR (TDC2 ONLY)	80009	672-0806-00
A13C31	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C32	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C55	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C58	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C64	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C65	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C66	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C67	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C68	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C73	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C75	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
A13C85	281-0752-00			CAP,FXD,CER DI:0.00175UF,10A	80009	281-0752-00
C82	281-0697-00			CAP,FXD,CER DI:5000PF,+100-0%,100V	72982	2425-003W5W0502Z
DS3	150-1036-00		B010100	LT EMITTING DIO:RED,650NM,40MA MAX	58361	Q6878/MV5074C
DS3	150-1077-00	B010101		LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
DS4	150-1036-00		B010100	LT EMITTING DIO:RED,650NM,40MA MAX	58361	Q6878/MV5074C
DS4	150-1077-00	B010101		LT EMITTING DIO:RED,650NM,40MA MAX	05464	LL201R
J1	131-1315-01			CONN,RCPT,ELEC:BNC,FEMALE	80009	131-1315-01
Q25	156-1217-00			MICROCKT,LINEAR:OPTOELECTRONIC ISOLATOR (TDC1 ONLY)	32694	OPB706A
R5	015-1025-01			TERMN,COAXIAL:3MM MALE 50OHM W/CH	80009	015-1025-01

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
R6	015-1025-01			TERMN,COAXIAL:3MM MALE 50OHM W/CH	80009	015-1025-01
W1	175-2580-00			CABLE ASSY,RF:50 OHM SEMI RIGID,4.5 L (J02-J11)	80009	175-2580-00
W2	175-2600-00			CABLE ASSY,RF:50 OHM COAX,6.0 L (J12-J08)	80009	175-2600-00
W3	175-2590-00			CABLE ASSY,RF:50 OHM COAX,3.0 L (J8-A3P81)	TK1375	ORDER BY DESCR
W4	175-2595-00			CABLE ASSY,RF:50 OHM COAX,5.0 L (A3P85-A4L52)	80009	175-2595-00
W5	175-2592-00			CABLE ASSY,RF:50 OHM COAX,4.5 L (A4L57-A5P03)	80009	175-2592-00
W6	175-2592-00			CABLE ASSY,RF:50 OHM COAX,4.5 L (A5P89-A6L52)	80009	175-2592-00
W7	175-2594-00			CABLE ASSY,RF:50 OHM COAX,4.0 L (A6L57-A7P77)	80009	175-2594-00
W8	175-2601-00			CABLE ASSY,RF:50 OHM COAX,15.0 L (A7IP13-J01)	80009	175-2601-00
W9	175-2597-00			CABLE ASSY,RF:50 OHM COAX,2.5 L (A8P73-J09)	80009	175-2597-00
W10	175-2590-00			CABLE ASSY,RF:50 OHM COAX,3.0 L (J09-A3P15, TDC2 ONLY)	TK1375	ORDER BY DESCR
W11	175-2596-00			CABLE ASSY,RF:50 OHM COAX,8.0 L (A8P35-J10)	80009	175-2596-00
W12	175-2593-00			CABLE ASSY,RF:50 OHM COAX,4.5 L (J10-A9P65)	80009	175-2593-00
W13	175-2598-00			CABLE ASSY,RF:50 OHM COAX,3.0 L (A8P78-J05)	80009	175-2598-00
W14	175-2599-00			CABLE ASSY,RF:50 OHM COAX,5.0 L (A11P48-A7P17)	80009	175-2599-00
W15	175-2599-00			CABLE ASSY,RF:50 OHM COAX,5.0 L (A11P45-J07)	80009	175-2599-00
W16	175-2602-00			CABLE ASSY,RF:50 OHM COAX,8.0 L (J07-J06)	80009	175-2602-00
W17	175-2591-00			CABLE ASSY,RF:50 OHM COAX,3.5 L (J11-A2P04)	80009	175-2591-00
W18	175-2591-00			CABLE ASSY,RF:50 OHM COAX,3.5 L (J12-A2P94)	80009	175-2591-00



SCHEMATIC EXAMPLE

2597-37

DIAGRAMS & CIRCUIT BOARD ILLUSTRATIONS

This section of the manual contains block and schematic diagrams with waveforms, and etched circuit board illustrations.

Symbols

Symbols used on the diagrams are based on ANSI Y32.2-1970 and IEEE No. 315 March 1971. Logic symbology is based on ANSI Y32.14-1973 (IEEE Std. 91-1973). Logic symbols depict the logic function performed and may differ from the manufacturer's data.

Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in micofarads (μF).

Resistors = Ohms (Ω).

Semiconductor Types

Refer to the Electrical Parts List.

Reference Designators

The following letters are used as reference designators to identify components or assemblies on Tektronix, Inc. schematic diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	**LR**	Inductor/resistor combination
AT	Attenuator, fixed or variable	**M**	Meter
B	Motor	**P**	Connector, movable portion
BT	Battery	**Q**	Transistor, silicon-controlled rectifier, or programmable unijunction transistor
C	Capacitor, fixed or variable		
CR	Diode, signal or rectifier	**R**	Resistor, fixed or variable
DH	Decoupling Hybrid	**RT**	Thermistors
DL	Delay Line	**S**	Switch
DS	Indicating device (lamp)	**T**	Transformer
E	Spark Gap	**TC**	Thermocouple
F	Fuse	**TP**	Test Point
FL	Filter	**U**	Assembly, inseparable or non-repairable (integrated circuit, etc.)
H	Heat dissipating device (heat sink, heat radiator, etc.)	**V**	Electron tube
HR	Heater	**VR**	Voltage regulator (zener diode, etc.)
J	Connector, stationary portion	**Y**	Crystal
K	Relay		
L	Inductor, fixed or variable		

Partial Schematic Diagram With Explanations

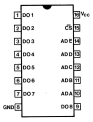
The partial diagram at the left is an example of the various symbols and other information provided on Tektronix, Inc. diagrams.

WAVEFORM CONDITIONS

Phase-lock loop searching (unlocked with front panel LED's blinking "on" and "off" alternately).

IC BASING DIAGRAMS

LM358



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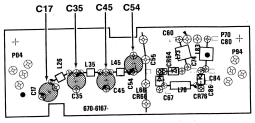
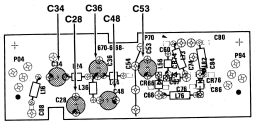
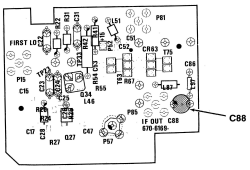
LM301AN



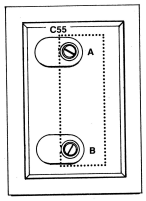
A2V VHF PIN ATTENUATOR BOARD



A2U UHF PIN ATTENUATOR BOARD



A3 1st MIXER BOARD



A4 1st IF BANDPASS FILTER
A6 1st IF BANDPASS FILTER

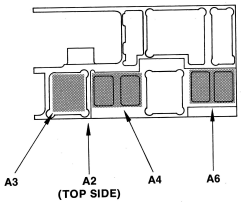
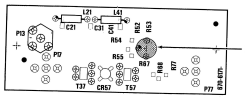
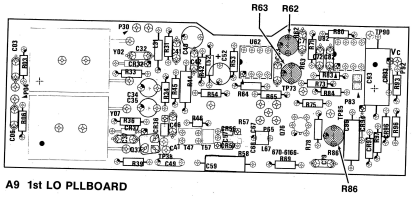


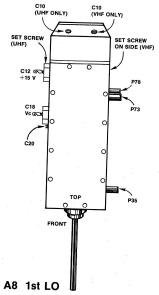
Figure 8-1. ADJUSTMENT LOCATIONS.



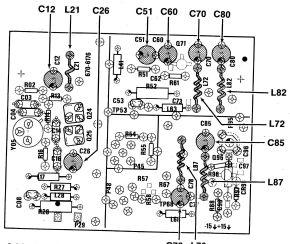
A7 2nd MIXER BOARD



A9 1st LO PLLBOARD



A8 1st LO



A11 2nd LO BOARD

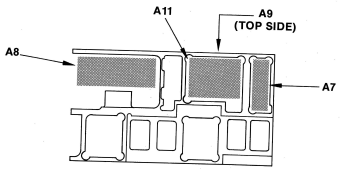
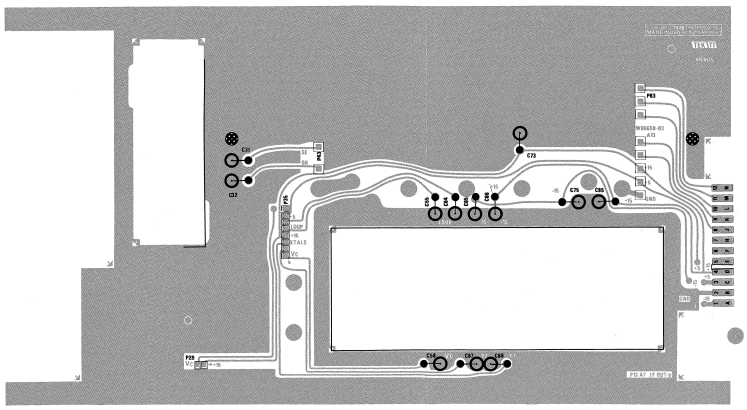


Figure 8-2. ADJUSTMENT LOCATIONS.

2764-37

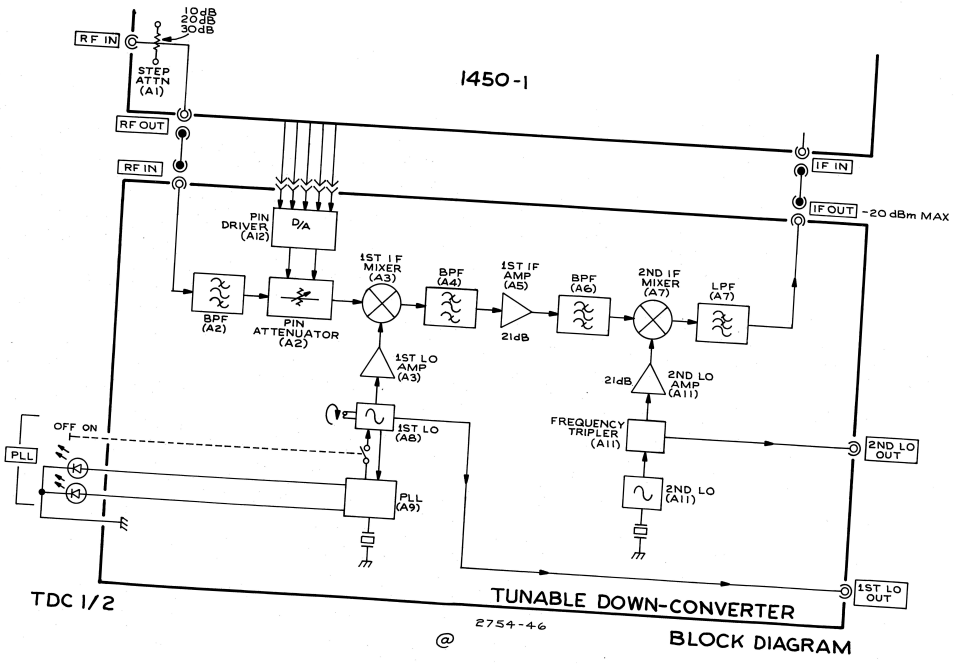


A13 TDC INTERCONNECT BOARD

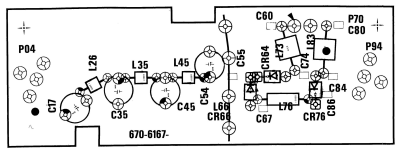
COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number — Subassembly Number (if used) — Schematic Circuit Number

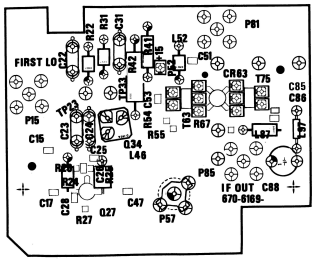
Chassis mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.


1450-1
10dB
20dB
30dB
RF IN
STEP ATTN (A1)
RF OUT
RF IN
IF IN
IF OUT -20 dBm MAX
PIN DRIVER (A12)
D/A
BPF (A2)
PIN ATTENUATOR (A2)
1ST IF MIXER (A3)
BPF (A4)
1ST IF AMP (A5)
21dB
BPF (A6)
2ND IF MIXER (A7)
LPF (A7)
1ST LO AMP (A3)
21dB
2ND LO AMP (A11)
OFF ON
PLL
1ST LO (A8)
PLL (A9)
FREQUENCY TRIPLER (A11)
2ND LO OUT
2ND LO (A11)
1ST LO OUT
TUNABLE DOWN-CONVERTER
BLOCK DIAGRAM
TDC 1/2
2754-46

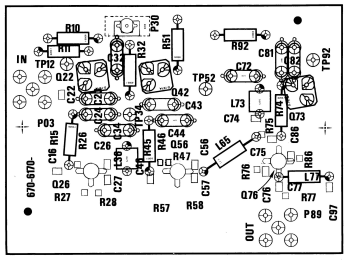
TDC1/2



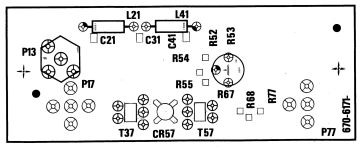
A2V VHF PIN ATTENUATOR BOARD



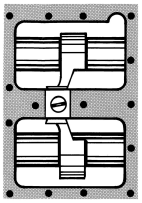
A3V 1st MIXER BOARD



A5 1st IF AMP BOARD



A7 2nd MIXER BOARD



A4 1st IF BANDPASS FILTER
A6 1st IF BANDPASS FILTER

Circuit Number	Schematic Location	Board Location
ASSY A2V		
C17	A2	B3
C35	A2	G3
C45	A2	D3
C54	A2	E2
C55	A2	E2
C60	A2	E2
C67	A3	E3
C74	A3	F2
C80	A2	G2
C84	A3	F3
C86	A3	F3
CR64	A3	E2
CR66	A3	E3
CR76	A3	F3
L26	A2	C3
L35	A2	D2
L45	A2	D2
L66	A3	E3
L73	A2	F2
L76	A3	F3
L83	A2	F2
P04	A2	B2
P94	A3	G2

SIGNAL PATH PROCESSING SYSTEM (1) v

Circuit Number	Schematic Location	Board Location
ASSY A3V		
C15	B4	B7
C17	B4	B7
C22	A5	B5
C23	B4	B6
C24	B4	C6
C25	B4	C7
C26	B4	G7
C28	B4	B7
C31	A4	C5
C47	B4	C7
C51	B4	D5
C53	B4	D6
C85	B5	F6
C86	B5	F6
C88	B5	F7
CR63	B5	E6
L46	B4	G7
L52	B4	D5
L87	B5	E6
L97	B5	F6
P15	B3	B6
P57	B4	D8
P81	A3	E5
P85	B5	E7
Q27	B4	C7
Q34	A4	C6
R22	B4	C5
R24	B4	C7
R25	B4	C7
R26	B4	B7
R27	B4	C8
R31	A4	C5
R41	A5	D5
R42	A4	C5
R54	B4	D6
R55	B4	D6
R67	B5	E6
T63	B4	D6
T75	B5	E6
TP23	A4	B6
TP33	A4	C6
ASSY A5		
C16	D1	I4
C22	D1	I3
C23	D1	J3
C24	D1	J3
C26	D1	J4
C27	D2	J4
C32	C2	J2
C34	C2	J3
C43	D2	K3
C44	D2	K3
C46	D2	K4
C66	D2	K4
C67	D2	K4
C72	C2	L2
C74	C2	L3
C75	D2	M3
C76	D3	M4
C77	C3	M4
C81	C3	M2
C82	C3	M2
C86	D3	M3
C97	C3	N4
L36	C1	J4
L65	D2	L4
L73	C2	L3
L77	C3	M4
P03	D1	I3
P89	C3	M5
Q22	C1	J2
Q26	D1	J4
Q42	C2	K3
Q56	D2	K4
Q73	D3	M3
Q76	D3	M4
R10	C1	I2
R11	C1	I2
R15	D1	I3
R26	D1	J4
R27	D1	J4
R28	D2	J4
R32	C1	J2
R45	D2	K4
R46	D2	K4
R47	D2	K4
R51	C2	K2
R57	D2	K3
R58	D2	K3
R74	C3	M3
R75	D2	M3
R76	D3	L4
R77	D3	M4
R86	D3	M4
R92	C3	L2
TP12	C1	I2
TP34	C2	K3
TP52	C2	L3
TP92	C3	M2
ASSY A7		
C21	C5	J7
C31	C5	K7
C41	C5	K7
CR57	D5	K8
L21	C5	J7
L41	C5	K7
P13	C5	I7
P17	C5	I8
P77		M8
R52	C5	L7
R53	C4	L7
R54	C5	L7
R55	C5	L7
R67	D4	L8
R68	D4	L8
R77	D4	L8
T37	C5	J8
T57	D4	L8
P/O ASSY A13		
C31	A2	E3
C32	A2	E4
C73	C1	I3

Component locations for A13 are shown on the reverse side of Figure 8-2.

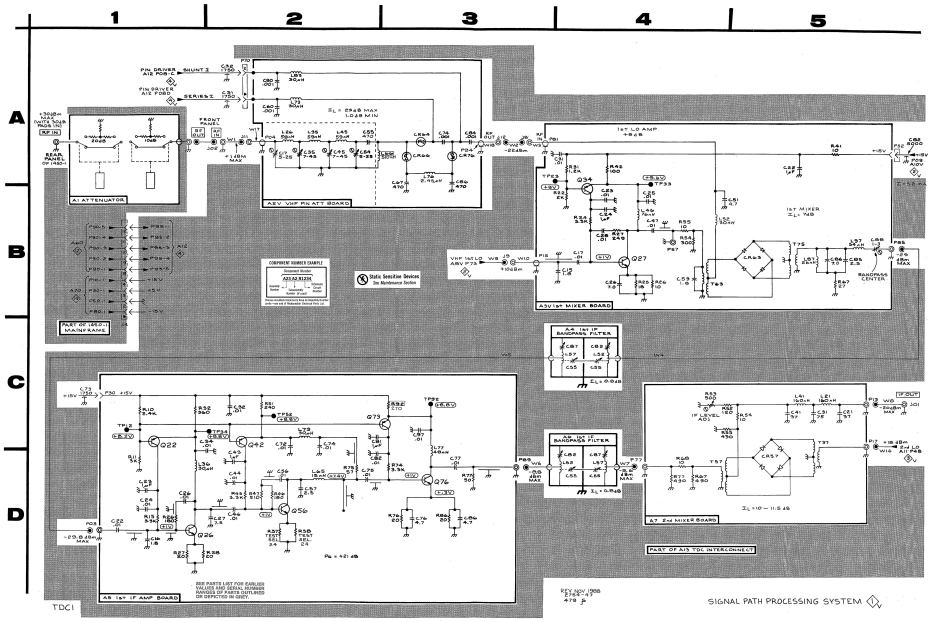
COMPONENT NUMBER EXAMPLE

Component Number: A23 A2 R1234
- A23 — Assembly Number
- A2 — Subassembly Number (if used)
- R1234 — Schematic Circuit Number

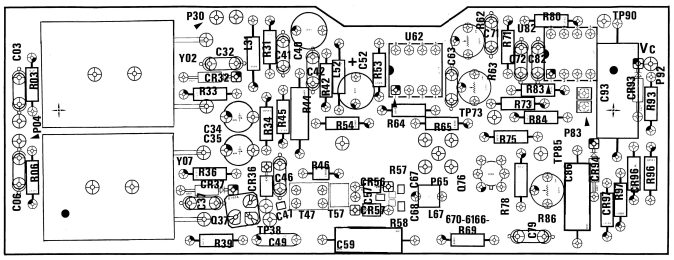
Factory-selected components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Static Sensitive Devices
See Maintenance Section

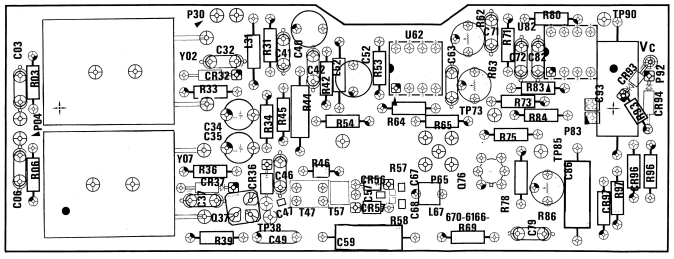
2754-39


1
2
3
4
5
A
B
C
D
A1 ATTENUATOR
A2V VHF PIN ATT BOARD
A3V 1st MIXER BOARD
A4 1st IF BANDPASS FILTER
A5 1st IF AMP BOARD
A7 2nd MIXER BOARD
PART OF A13 TDC INTERCONNECT
PART OF 1450-1 MAINFRAME
CONFIDENCE FIGURES CHART
Static Sensitive Devices
See Maintenance Section
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBERS NUMBER OF PARTS OUTLINED OR DEPICTED IN DIRECT
TDC1
SIGNAL PATH PROCESSING SYSTEM

TDC1/2



A9V 1st LO PLL BOARD
(SN B010150—UP)



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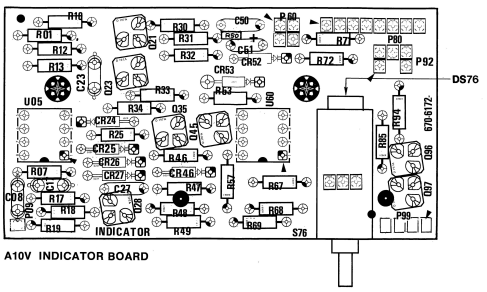
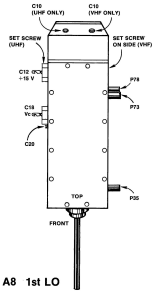
(SN B010100—B010149)



A10V INDICATOR BOARD



A8 1st LO

VHF 1st LO SYSTEM <2>v

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
ASSY A9V		
C03	B1	A2,A7
C06	B1	A3,A8
C32	A1	D2,D6
C34	A1	D3,D7
C35	A2	D3,D7
C37	A1	D4,D8
C40	B1	E1,E6
C41	B1	E1,E6
C42	B1	E2,E6
C46	A2	E3,E8
C47	A2	E4,E9
C49	A2	E4,E9
C52	B1	F2,F6
C57	A3	F4,F8
C59	A2	F4,F9
C63	A3	H1,H6
C67	A3	G3,G8
C68	A3	G4,G9
C71	A3	H1,H6
C72	A4	I2,I6
C79	A4	H,I9
C82	A4	I2,I6
C86	B3	I3,I8
C93	A4	J2,J7
CR32	A1	D2,D7
CR36	A2	E3,E8
CR37	A1	D3,D8
CR56	A3	F3,F8
CR57	A3	F4,F9
CR93	A4	J2,J7
CR94	A4	J3,K7
CR96	B4	J4,J8
CR97	B4	J4,J8
L31	B1	E1,E6
L52	B1	F2,F6
L67	A3	G4,G9
P65	A3	G3,G8
Q37	A2	D4,D9
Q76A	A3	H3,H8
Q76B	A3	H3,H8
R03	A1	A2,A7
R06	A2	A3,A8
R31	B1	E1,E6
R33	A1	D2,D7
R34	A1	D3,D7
R36	A1	D3,D8
R39	A2	D4,D9
R42	B1	F2,F7
R44	A2	E2,E7
R45	A2	E2,E7
R46	A2	F3,F8
R53	A3	F2,F6
R54	A1	F3,F7
R57	A3	G3,G8
R58	A3	G4,G9
R62	A3	H1,H6
R63	A3	H2,H7
R64	A3	G2,G7
R65	A3	G3,G7
R69	A2	H4,H9
R71	A4	H1,H6
R73	A4	I2,I7
R75	A3	H3,H7
R78	A3	I3,I8
R80	A4	I1,I6
R83	A4	I2,I7
R84	A4	I2,I7
R86	B3	I4,I9
R93	A4	K2,J7
R96	B4	K3,K8
R97	B4	J4,J8
T47	A2	E4,E9
T57	A2	F4,F9
TP38	A2	E4,E9
TP73	A3	H2,H7
TP85	A3	I3,I8
TP90	A4	J1,J6
U82	A3	G1,G6
U82	A4	I1,I6
VR94	A4	
ASSY A10V		
C08	D2	L4
C17	C2	L3
C23	D3	M2
C27	C3	N4
C90	C2	O1
C51	D2	O1
DS76	C4	Q2
CR24	C3	M3
CR25	C3	M3
CR26	D3	M3
CR27	C3	M3
CR46	D3	N3
CR52	D3	O2
CR53	D3	O2
Q21	C2	N1
Q23	C4	M2
Q28	C3	N4
Q35	C4	N2
Q45	C3	O3
Q66	D4	R3
Q97	D4	R3
R01	C2	L1
R07	C2	L3
R10	C2	M1
R12	C2	M1
R13	D3	M2
R17	C2	M4
R18	C3	M4
R19	D3	M4
R25	C3	M3
R30	C2	N1
R31	C2	N1
R32	C2	N1
R33	C4	N2
R34	C3	N2
R46	C3	N3
R47	C3	O3
R48	C3	N4
R49	C3	N4
R50	C2	O1
R53	D3	O2
R57	D3	O3
R67	D3	P3
R68	D3	P4
R69	D3	P4
R71	D2	Q1
R72	D3	Q2
R85	D4	Q3
R94	D4	R2
S76A	C4	Q4
S76B	D3	Q4
S76C	C4	Q4
U05A	C3	L2
U05B	C2	L2
U60A	D3	P2
U60B	D3	P2
P/O ASSY A13		
C55	A4	H4
C58	A4	H6
C64	B4	H4
C65	B1	H4
C66	B1	H4
C67	A1	H6
C68	B1	I6

Component locations for A13 are shown on the reverse side of Fig. 8-2.

Static Sensitive Devices
See Maintenance Section

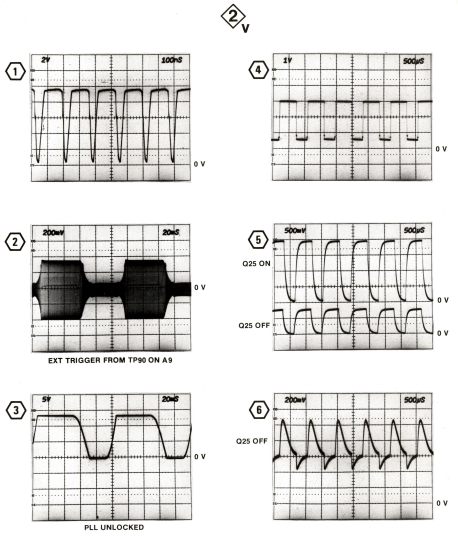
COMPONENT NUMBER EXAMPLE

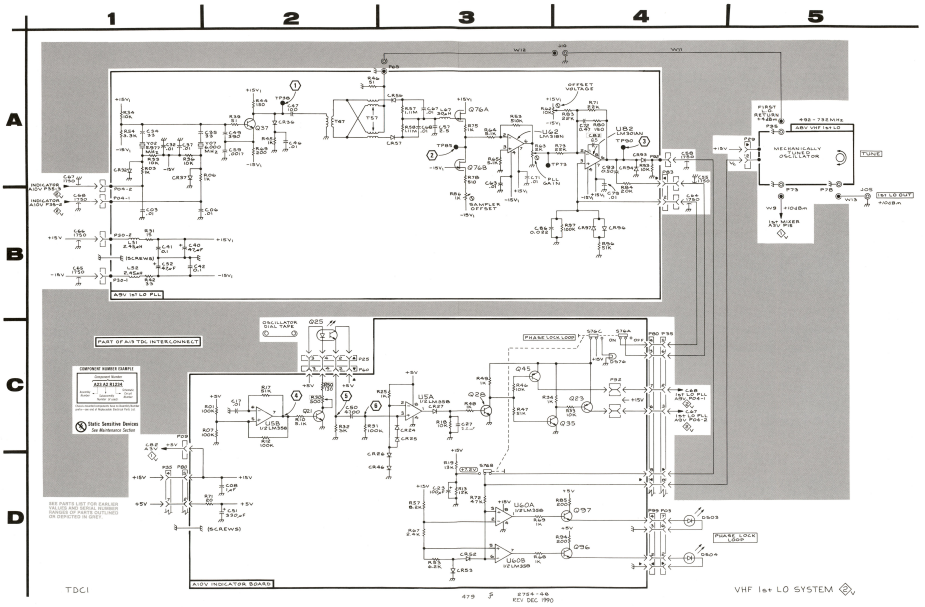
Component Number: A23 A2 R1234
- Assembly Number
- Subassembly Number (if used)
- Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

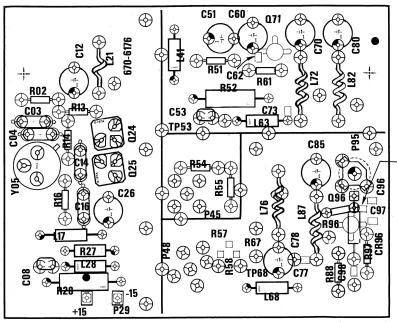
2754-40

REV DEC 1990


2V
100nS
0 V
1V
50µS
0 V
200mV
20nS
0 V
EXT TRIGGER FROM TP90 ON A9
500mV
50µS
Q25 ON
0 V
Q25 OFF
0 V
5V
20nS
0 V
PLL UNLOCKED
200mV
50µS
Q25 OFF
0 V


1
2
3
4
5
A
B
C
D
A3V1 INT LO PLL
A3V INDICATOR BOARD
PART OF A3 TDL INTERCONNECT
PHASE LOCK LOOP
OSCILLATOR DIAL TAPE
FIRST LO (VCO) A3V1W8
492-738MHz
A3V VHF INT LO
MECHANICALLY TUNED OSCILLATOR
TUNE
INT LO OUT
+10dBm
W8 +10dBm
INJECTION A3V1W8
OFFSET VOLTAGE
LOCK INDICATOR
INDICATOR A3V1 P2
A3V1 P2
A3V1 P1
A3V1 P3
A3V1 P4
A3V1 P5
A3V1 P6
A3V1 P7
A3V1 P8
A3V1 P9
A3V1 P10
A3V1 P11
A3V1 P12
A3V1 P13
A3V1 P14
A3V1 P15
A3V1 P16
A3V1 P17
A3V1 P18
A3V1 P19
A3V1 P20
A3V1 P21
A3V1 P22
A3V1

TDC1/2



A11 2nd LO BOARD

VHF 2nd LO SYSTEM ◇3▽

Circuit Number	Schematic Location	Board Location
ASSY A11		
C03	C2	B3
C04	C2	B4
C06	D3	B6
C12	C3	C2
C14	C2	C4
C16	C2	C5
C26	C3	C5
C51	C3	E2
C53	B3	D3
C60	C3	E2
C62	C3	E3
C70	C3	F2
C73	B3	F3
C77	B4	F8
C78	B4	F5
C80	C3	G2
C85	B4	F4
C86	B4	G5
C96	B4	G4
C97	C4	G5
C99	C4	G6
CR96	C4	G5
L17	C2	B5
L21	C3	C2
L28	D2	C8
L41	C3	D2
L63	B3	F3
L68	B4	F8
L72	B3	F3
L76	B4	E5
L82	B3	G3
L87	B4	F5
P45	C4	D8
P48	B4	D6
P95	B3	G4
Q24	C3	C4
Q25	C3	C4
Q71	C3	F2
Q96	C4	G5
R02	C2	B3
R13	C2	C3
R14	C2	B4
R16	C2	B5
R27	C3	C5
R28	B3	B6
R51	C3	E2
R52	B3	E3
R54	C4	D4
R55	C4	E4
R57	B4	E5
R58	B4	E6
R61	C3	F3
R67	B4	E5
R88	C4	G6
R96	B4	F5
R97	C4	G5
TP53	B3	D3
TP88	B4	E6
Y05	C2	B4
P/O ASSY A13		
C75	D2	J4
C85	B2	J4

Component locations for A13 are shown on the reverse side of Figure 8-2.

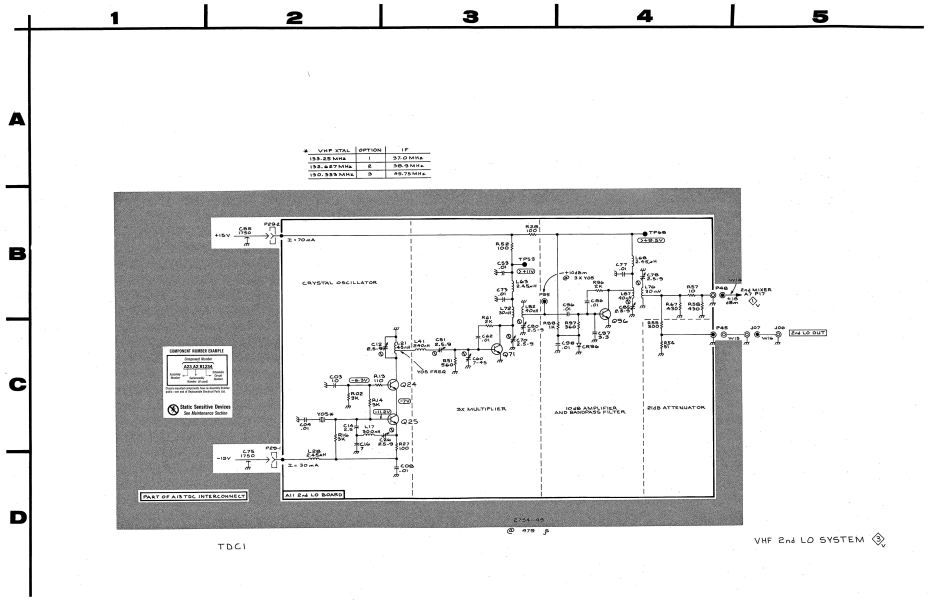
COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number | Subassembly Number (if used) | Schematic Circuit Number

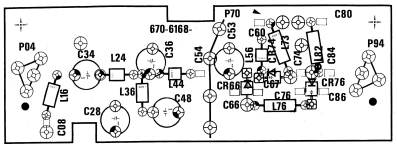
Chassis-mounted components have no Assembly Number prefix – see end of Replaceable Electrical Parts List.

Static Sensitive Devices
See Maintenance Section

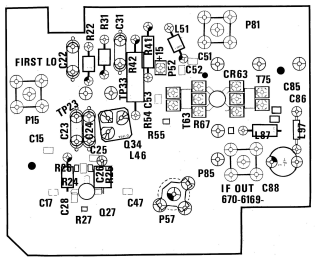
2764-41


1
2
3
4
5
A
B
C
D
* VHF XTAL | OPTION | IF
153.25 MHz | 1 | 37.0 MHz
152.627 MHz | 2 | 36.9 MHz
150.525 MHz | 3 | 45.75 MHz
+15V
-15V
CRYSTAL OSCILLATOR
3X MULTIPLIER
10dB AMPLIFIER AND BANDPASS FILTER
2dB ATTENUATOR
2nd LO OUT
All 2nd LO BOARD
PART OF A/B TSC INTERCONNECT
TDC1
VHF 2nd LO SYSTEM

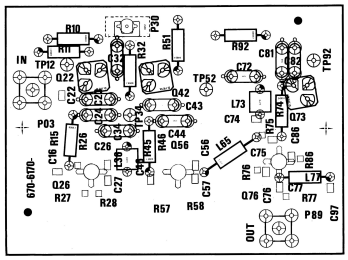
TDC1/2



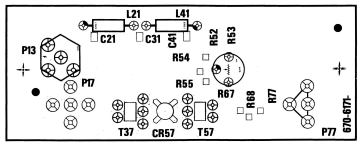
A2U UHF PIN ATTENUATOR BOARD



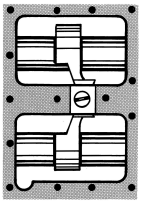
A3U 1st MIXER BOARD



A5 1st IF AMP BOARD



A7 2nd MIXER BOARD



A4 1st IF BANDPASS FILTER
A6 1st IF BANDPASS FILTER

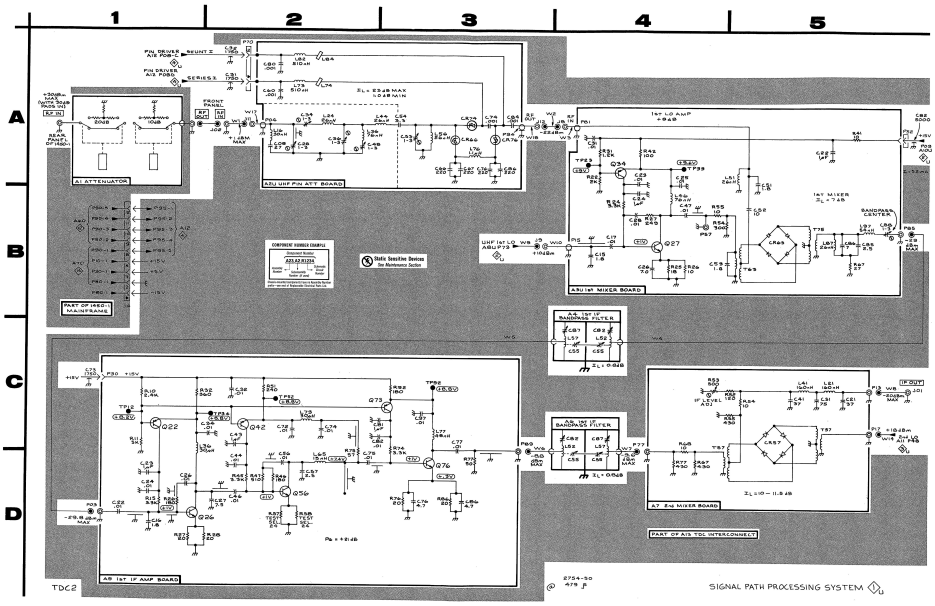
SIGNAL PATH PROCESSING SYSTEM ① u

Circuit Number	Schematic Location	Board Location
ASSY A3U		
C15	B4	B7
C17	B4	B7
C22	A5	B5
C23	A4	C6
C24	B4	C6
C29	A4	C7
C36	B4	C7
C38	B4	B7
C51	A4	C5
C47	B4	C7
C51	A5	D5
C52	B5	D5
C53	B4	D6
C85	B5	F6
C86	B5	F6
C88	B5	F7
CR63	B5	E6
L46	B4	C7
L51	A5	D5
L87	B5	E6
L97	B5	F6
P15	B3	B6
P57	B4	D7
P81	A3	E5
P85	B5	E7
Q27	B4	C7
Q34	A4	C6
R22	A4	C5
R24	B4	B7
R25	B4	
R26	B4	B7
R27	B4	C8
R31	A4	C5
R41	A5	D5
R42	A4	C5
R54	B4	D6
R55	B4	D6
R67	B5	E6
T63	B5	D6
T75	B5	E6
TP23	A4	C6
TP33	A4	C6
ASSY A5		
C16	D1	I4
C22	D1	I3
C23	D1	J3
C24	D1	J3
C26	D1	J4
C27	D2	J4
C32	C2	J2
C34	C2	J3
C43	C2	K3
C44	D2	K3
C46	D2	K4
C56	D2	K4
C57	D2	K4
C72	C2	L2
C74	C2	L3
C75	D2	M3
C76	D3	M4
C77	C3	M4
C81	C3	M2
C82	C3	M2
C86	D3	M3
C97	C3	N4
L36	C1	J4
L65	C2	L4
L73	C2	L3
L77	C3	M4
P03	D1	I3
P89	C3	M5
Q22	C1	J2
Q26	D1	J4
Q42	D2	K3
Q56	D2	K4
Q73	C3	M3
Q76	C3	M4
R10	C1	I2
R11	C1	I2
R15	D1	I3
R26	D1	J4
R27	D1	J4
R28	D2	J4
R32	C1	J2
R45	D2	K4
R46	D2	K4
R47	D2	K4
R51	C2	K2
R57	D2	K5
R58	D2	K5
R74	C3	M3
R75	D2	M3
R76	D3	L4
R77	D3	M4
R86	C3	M4
R92	C3	L2
TP12	C1	I2
TP34	C2	K3
TP52	C2	L3
TP92	C3	M2
ASSY A7		
C21	C5	J7
C31	C5	K7
C41	C5	K7
CR57	C5	K8
L21	C5	J7
L41	C5	K7
P13	C5	I7
P17	C5	I8
P77		M8
R52	C5	L7
R53	C4	L7
R54	C5	L7
R55	C5	L7
R67	D4	L8
R68	D4	L8
R77	D4	L8
T37	C5	J8
T57	C4	L8
P/O ASSY A13		
C31	A2	E3
C32	A2	E4
C73	A2	I3

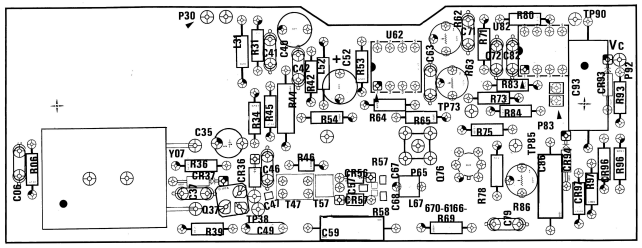
Component locations for A13 are shown on the reverse side of Figure 8-2.

Circuit Number	Schematic Location	Board Location
ASSY A2U		
C08	A2	B3
C28	A2	C3
C34	A2	C2
C36	A2	D2
C48	A2	D3
C53	A3	E2
C54	A3	E2
C60	A2	E2
C66	A3	E3
C67	A3	F3
C74	A3	F2
C76	A3	F3
C80	A2	G2
C84	A3	G2
C86	A3	G3
CR66	A3	E3
CR74	A3	F2
CR76	A3	G3
L16	A2	B3
L24	A2	C2
L36	A2	C3
L44	A3	D3
L56	A3	E2
L73	A2	F2
L74	A2	
L76	A3	F3
L82	A2	F2

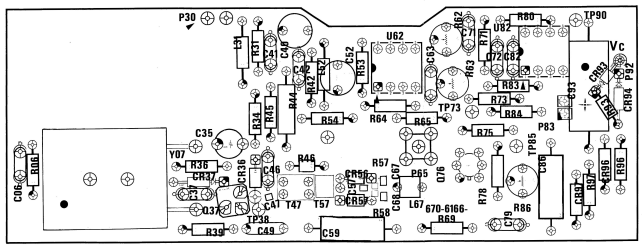
3754-42


1
2
3
4
5
A
B
C
D
A1 ATTENUATOR
A2U UHF PIN ATT BOARD
A3U 1st MIXER BOARD
A4 1ST IF BANDPASS FILTER
A5 2nd IF BANDPASS FILTER
A6 1st IF AMP BOARD
A7 2nd MIXER BOARD
PART OF IFEQ MAINFRAME
PART OF A15 TDL INTERCONNECT
Static Sensitive Devices
See Maintenance Section
TDC2
2754-30
478 J
SIGNAL PATH PROCESSING SYSTEM

TDC1/2



A9U 1st LO PLL BOARD
(SN B010150—UP)



A9U 1st LO PLL BOARD
(SN B010100—B010149)

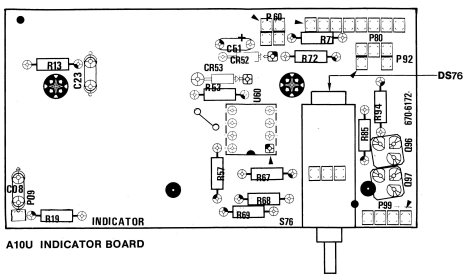
Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

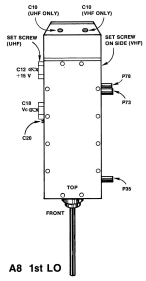
Component Number: A23 A2 R1234
(Assembly Number; Subassembly Number (if used); Schematic Circuit Board Location)

Diode-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

2754-43



A10U INDICATOR BOARD



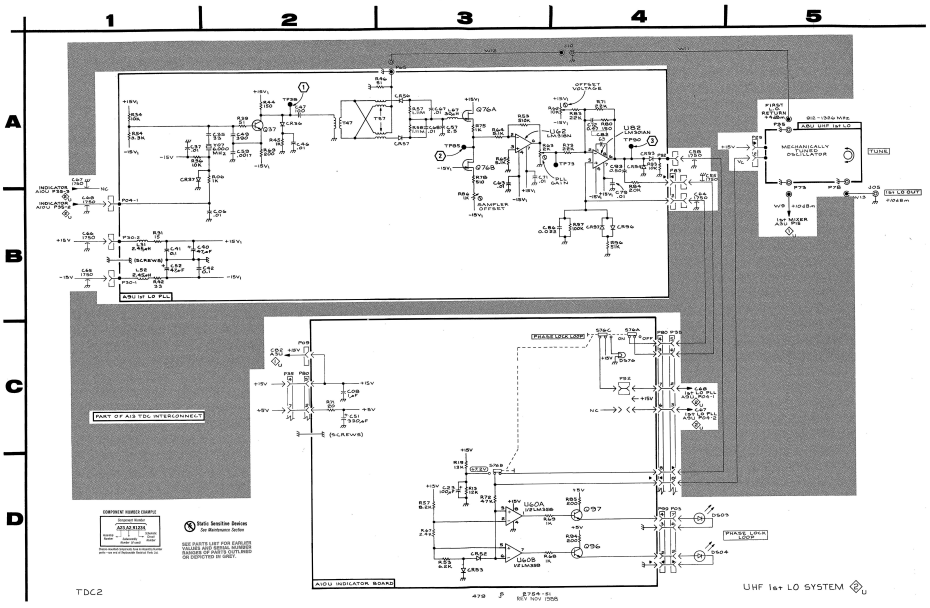
A8 1st LO

UHF 1st LO SYSTEM (2) u

Circuit Number	Schematic Location	Board Location
ASSY A9U		
C06	B2	A3,A8
C35	A2	D3,D8
C37	A1	D4,D6
C40	B1	E1,E8
C41	B1	E1,E6
C42	B1	E2,E8
C45	A2	E3,E8
C47	A2	E4,E8
C48	A2	E4,E6
C49	B1	F4,F8
C52	A3	F4,F6
C53	A3	F4,F5
C55	A3	H1,H7
C62	A3	G3,G8
C65	A3	G4,G8
C66	A3	H1,H6
C68	A3	I2,I6
C69	A3	I2,I5
C72	A4	I2,I6
C79	B4	I4,I9
C82	A4	I2,I6
C96	B4	I3,I8
C93	A4	J2,J7
CR36	A2	E3,E8
CR37	A1	D3,D8
CR56	A3	F3,F8
CR57	A3	F4,F8
CR93	A4	J2,J7
CR94	A4	J3,K7
CR96	B4	J3,J8
CR97	B4	J4,J8
L31	B1	E1,E6
L52	B1	F2,F6
L67	A3	G4,G9
P65	A3	G3,G8
Q37	A2	D4,D9
Q76A	A3	H3,H8
Q76B	A3	H3,H8
R06	A2	A3,A8
R31	B1	E1,E5
R34	A1	E2,E7
R36	A1	D3,D6
R39	A2	D4,D9
R42	B1	F2,F7
R44	A2	E2,E7
R45	A2	E2,E7
R46	A3	F3,F8
R53	A3	F3,F7
R54	A1	E3,E8
R57	A3	G3,G8
R58	A3	G4,G9
R63	A3	H1,H8
R64	A3	G2,G7
R65	A3	G3,G7
R69	A2	H4,H9
R71	A4	H1,H6
R73	A4	I2,I7
R75	A3	H3,H7
R78	A3	I3,I8
R80	A4	I1,I6
R83	A4	I2,I7
R84	A4	I2,I7
R86	B3	I4,I9
R93	A4	K2,J7
R96	B4	K3,K8
R97	B4	J4,J8
T47	A2	E4,E9
T57	A3	F4,F9
TP38	A2	E4,E9
TP73	A4	H2,H7
TP85	A3	I3,I8
TP90	A4	J1,J6
U62	A3	G1,G6
U82	A4	I1,I6
Y07	A2	C3,C8
ASSY A10U		
C08	C2	L4
C23	D3	M2
C51	C2	O1
CR52	D3	O2
CR53	D3	O2
DS76	C4	Q2
P92	C3	R2
Q96	D4	R3
Q97	D4	R3
R13	D3	M2
R19	D3	L4
R53	D3	O2
R57	D3	O3
R67	D3	P3
R68	D3	P4
R69	D3	P4
R71	C2	Q1
R72	D3	Q2
R85	D4	Q3
R94	D4	R2
S76A	C3	Q4
S76B	D3	Q4
S76C	C3	Q4

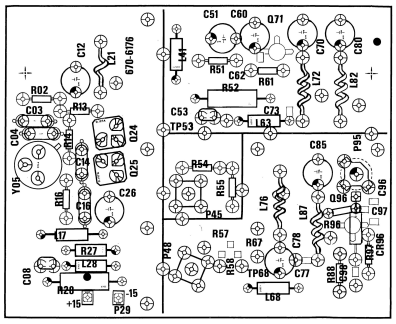
Circuit Number	Schematic Location	Board Location
P/O ASSY A13		
U60A	D3	P2
U60B	D3	P2
C55	A4	H4
C56	A4	H6
C64	B4	H4
C65	B1	H4
C66	B1	H4
C67	A1	H6
C68	B1	I6

Component locations for A13 are shown on the reverse side of Figure 9-2.



1
2
3
4
5
A
B
C
D
A9U 1st LO PLL
A10U INDICATOR BOARD
PART OF A13 TDC INTERCONNECT
MECHANICALLY TUNED OSCILLATOR
TUNE
1st LO OUT
PHASE LOCK LOOP
OFFSET VOLTAGE
RAMPLER OFFSET
Static Sensitive Devices
See Maintenance Section
TDC2
UHF 1st LO SYSTEM

TDC1/2



A11 2nd LO BOARD

UHF 2nd LO SYSTEM (3) U

Circuit Number	Schematic Location	Board Location
ASSY A11		
C03	C2	B3
C04	C2	B4
C08	D3	B6
C12	D3	D2
C14	C2	C4
C16	C2	C5
C26	C3	D5
C51	D3	E2
C53	B3	D3
C60	C3	E2
C62	C3	E3
C70	D3	F2
C73	B4	F5
C77	B4	F6
C78	B4	F5
C80	C3	G2
C85	B4	F4
C86	B4	G5
C96	B4	G4
C97	C4	G5
C98	C4	G6
CR96	C4	G5
L17	C2	B5
L21	C3	C2
L28	D2	C6
L41	C3	D2
L63	B3	F3
L68	B4	F6
L72	B3	F3
L76	B4	E5
L82	B3	G3
L87	B4	F5
P45	C4	D5
P48	B4	D6
P95	B4	G4
Q24	C3	C4
Q25	C3	C4
Q71	C3	F2
Q96	C4	G5
R02	C2	B3
R13	C2	C3
R14	C2	B4
R16	C2	B5
R27	C3	C5
R28	B3	B6
R51	C3	E2
R52	B3	E3
R54	C4	D4
R55	C4	E4
R57	B4	E5
R58	B4	E6
R61	C3	F3
R67	B4	E5
R88	C4	G6
R96	B4	F5
R97	C4	G5
TP53	B3	D3
TP68	B4	E6
Y05	C2	B4
P/O ASSY A13		
C75	D2	J4
C85	B2	J4

Component locations for A13 are shown on the reverse side of Figure 8-3.

COMPONENT NUMBER EXAMPLE

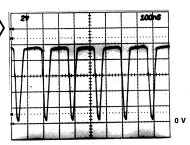
Component Number
A23 A2 R1234
Assembly Number — Subassembly Number (if used) — Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

Static Sensitive Devices
See Maintenance Section

2u

1



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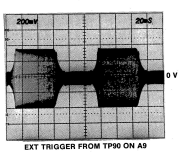
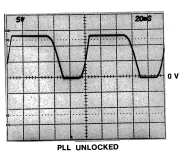


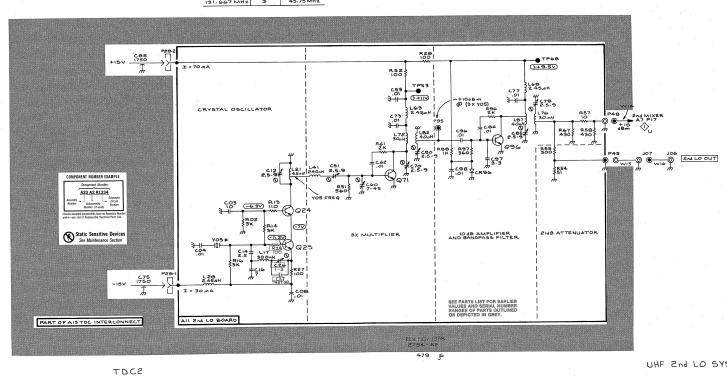
EXT TRIGGER FROM TP90 ON A9

3



PLL UNLOCKED

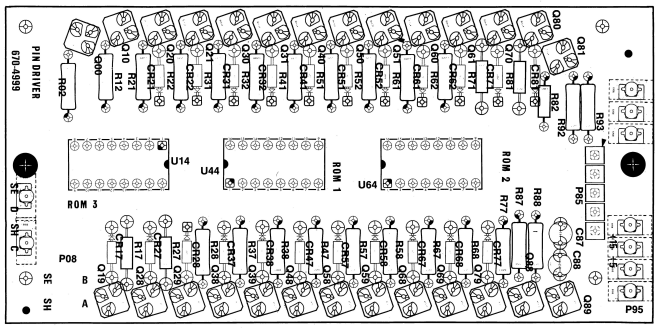
* UHF XTAL	OPTION	IF
134.583 MHz	1	37.0 MHz
133.950 MHz	2	38.9 MHz
131.667 MHz	3	45.75 MHz



TDC2

UHF 2nd LO SYSTEM 3u

TDC1/2



A12 PIN DRIVER BOARD

PIN DRIVER ◇4 u

Circuit Number	Schematic Location	Board Location
ASSY A12		
C87	A1	J5
C88	A1	J5
CR17	A2	C5
CR21	D2	D3
CR22	D2	D3
CR27	A2	D5
CR28	A2	D5
CR31	D3	E3
CR32	D3	F3
CR37	A3	E5
CR38	A3	F5
CR41	D3	F3
CR47	A3	F5
CR51	D4	G3
CR52	D4	G3
CR57	A4	G5
CR58	A4	G5
CR61	D4	H3
CR62	D5	I3
CR67	A4	H5
CR68	A4	I5
CR71	D5	I3
CR77	A5	I5
CR81	D5	J2
Q00	D2	C2
Q10	D2	C2
Q19	A2	C5
Q20	D2	D2
Q21	D2	E2
Q28	A2	D6
Q29	A2	D6
Q30	D3	E2
Q31	D3	F2
Q38	A3	E6
Q39	A3	E6
Q40	D3	F2
Q48	A3	F6
Q50	D4	G2
Q51	D4	H2
Q58	A3	G6
Q59	A4	G6
Q60	D4	H2
Q61	D5	I2
Q68	A4	H6
Q69	A4	H6
Q70	D5	I2
Q79	A5	I6
Q80	D5	J2
Q81	A1	J2
Q88	A5	J6
Q89	A5	K6
R02	D2	B3
R12	D2	C3
R17	A2	C5
R21	D2	D3
R22	D2	D3
R27	A2	D5
R28	A2	E5
R31	D3	E3
R32	D3	E3
R37	A3	E5
R38	A3	F5
R41	D3	F3
R47	A3	F5
R51	D4	G3
R52	D4	G3
R57	A3	G5
R58	A4	H5
R61	D4	H3
R62	D4	H3
R67	A4	H5
R68	A4	I5
R71	D5	I3
R77	A5	I5
R81	D5	J3
R82	A1	J2
R87	A5	J5
R88	A5	J5
R92	A1	J2
R93	A1	K3
U14	C1	D4
U44	B1	E4
U64	B1	G4

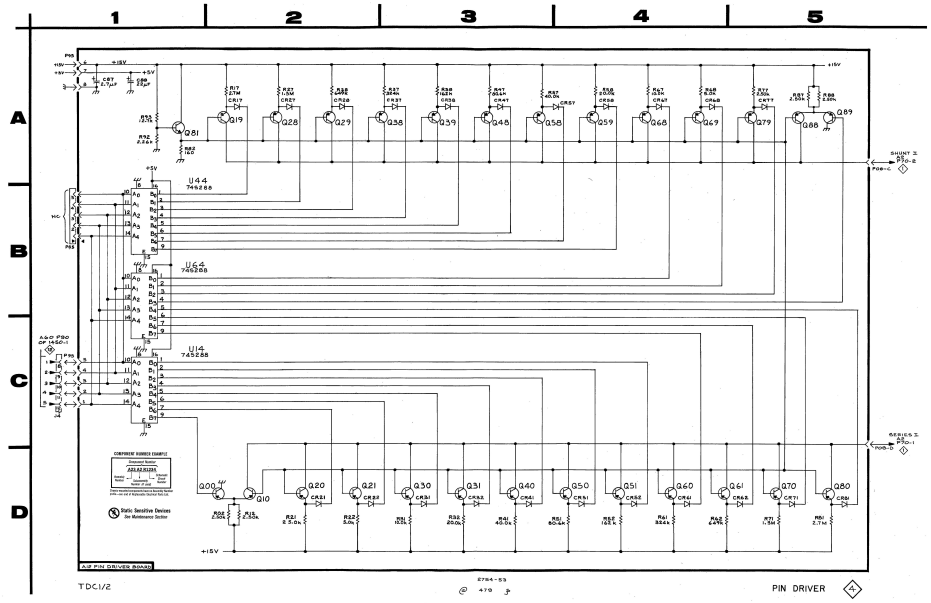
Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

Component Number
A23 A2 R1234
Assembly Number — Subassembly Number (if used) — Schematic Circuit Number

Factory-installed components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

2754-45


1
2
3
4
5
A
B
C
D
U44
745288
U64
745288
U14
745288
Q81
Q19
Q28
Q29
Q38
Q39
Q48
Q58
Q59
Q68
Q69
Q79
Q88
Q89
Q00
Q10
Q20
Q21
Q30
Q31
Q40
Q50
Q51
Q60
Q61
Q70
Q80
+15V
+5V
A12 PIN DRIVER BOARD
TDC1/2
PIN DRIVER

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

```
1 2 3 4 5                    Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
                **** END ATTACHING PARTS ****
  Detail Part of Assembly and/or Component
  Attaching parts for Detail Part
                **** END ATTACHING PARTS ****
    Parts of Detail Part
    Attaching parts for Parts of Detail Part
                **** END ATTACHING PARTS ****
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	200-2120-00	B010100	B010544	1	COVER,PLUG-IN:		
	200-2120-01	B010545		1	COVER,PLUG-IN:ALUMINUM (TDC 1 ONLY)		
	200-2120-00	B010100	B010390	1	COVER,PLUG-IN:		
	200-2120-01	B010391		1	COVER,PLUG-IN:ALUMINUM (TDC 2 ONLY) (ATTACHING PARTS)		
-2	211-0177-00			2	SCREW,MACHINE:4-40 X 0.312,PNH,STL (END ATTACHING PARTS)		
-3	351-0533-00			2	GUIDE,PL-IN UNI:ALUMINUM (ATTACHING PARTS)		
-4	213-0774-00			16	SCREW,TPG,TF:M3-0.5 X 10MM L,PNH,TAPTITE (END ATTACHING PARTS)		
-5	----- -----			1	CONN,RCPT,ELEC:(SEE J1 REPL)		
-6	----- -----			1	CABLE ASSY,RF:(SEE W1 REPL)		
-7	----- -----			2	LT EMITTING DIO:RED,650NM,40MA MAX (SEE DS03, DS04 REPL)		
-8	352-0451-00			1	HOLDER,LENS:0.125 ID,RUBBER		
-9	----- -----			1	CABLE ASSY,RF:(SEE W16 REPL)		
-10	----- -----			1	CABLE ASSY,RF:(SEE W13 REPL)		
-11	----- -----			2	TERM.,COAX:(SEE R05,R06 REPL)		
-12	331-0189-00			1	LENS,TAPE DIAL:1.52 X 0.53,ACRYLIC (ATTACHING PARTS)		
-13	210-0054-00			2	WASHER,LOCK:#4 SPLIT,0.025 THK STL		
-14	210-0406-00			2	NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL (END ATTACHING PARTS)		
-15	366-0402-00			1	KNOB:GY,0.126 ID X 0.825 OD X 0.67 H		
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL		
-16	333-2556-00			1	PANEL,FRONT: (TDC1 ONLY)		
	333-2556-01			1	PANEL,FRONT: (TDC2 ONLY) (ATTACHING PARTS)		
-17	211-0177-00			2	SCREW,MACHINE:4-40 X 0.312,PNH,STL (END ATTACHING PARTS)		
-18	----- -----			1	OSCILLATOR,RF:VHF OR UHF (SEE A8 REPL)		
-19	361-0979-00			1	SPACER,PLATE:0.062 X 1.25 X 3.475,AL (ATTACHING PARTS)		
-20	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ (END ATTACHING PARTS)		
-21	407-2357-00	B010100	B010157	1	BRACKET,ANGLE:SPROCKET WHEEL/IDLER,AL		
	407-2357-01	B010158	B010543	1	BRACKET,ANGLE:SPROCKET WHEEL/IDLER,AL		
	407-2357-02	B010544		1	BRACKET,ANGLE:SPROCKET WHEEL/IDLER (TDC1 ONLY)		
	407-2357-00	B010100	B010130	1	BRACKET,ANGLE:SPROCKET WHEEL/IDLER,AL		
	407-2357-01	B010131	B010384	1	BRACKET,ANGLE:SPROCKET WHEEL/IDLER,AL		
	407-2357-02	B010385		1	BRACKET,ANGLE:SPROCKET WHEEL/IDLER (TDC2 ONLY)		
-22	----- -----			1	MICROCIRCUIT,LI:OPTOELECTRONIC ISOLATOR (SEE Q25 REPL. TDC1 ONLY) (ATTACHING PARTS)		
-23	211-0038-00	B010100	B010543	2	SCREW,MACHINE:4-40 X 0.312,FLH,100 DEG,STL		
	211-0661-00	B010544		2	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,POZ (TDC1 ONLY)		
	211-0038-00	B010100	B010384	2	SCREW,MACHINE:4-40 X 0.312,FLH,100 DEG,STL		
	211-0661-00	B010385		2	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,POZ (TDC2 ONLY) (END ATTACHING PARTS) MICROCIRCUIT INCLUDES:		
	213-0195-00			2	.SETSCREW:2-56 X 0.188,STL		
-24	384-0636-02			2	SFT RTNR,DIAL:1.115 L X 0.312 OD,AL		
-25	214-0521-01			2	ROLLER,IDL TAPE:0.32 ID X 0.5 OD X 0.832 L		
-26	210-1043-01	B010100	B010157	2	WASHER,FLAT:0.254 ID X 0.685 OD X 0,02		
	210-1352-00	B010158		2	WASHER,FLAT:0.316 ID X 0.685 OD X 0.02,NYL (TDC1 ONLY)		
	210-1043-01	B010100	B010130	2	WASHER,FLAT:0.254 ID X 0.685 OD X 0,02		
	210-1352-00	B010131		2	WASHER,FLAT:0.316 ID X 0.685 OD X 0.02,NYL (TDC2 ONLY)		

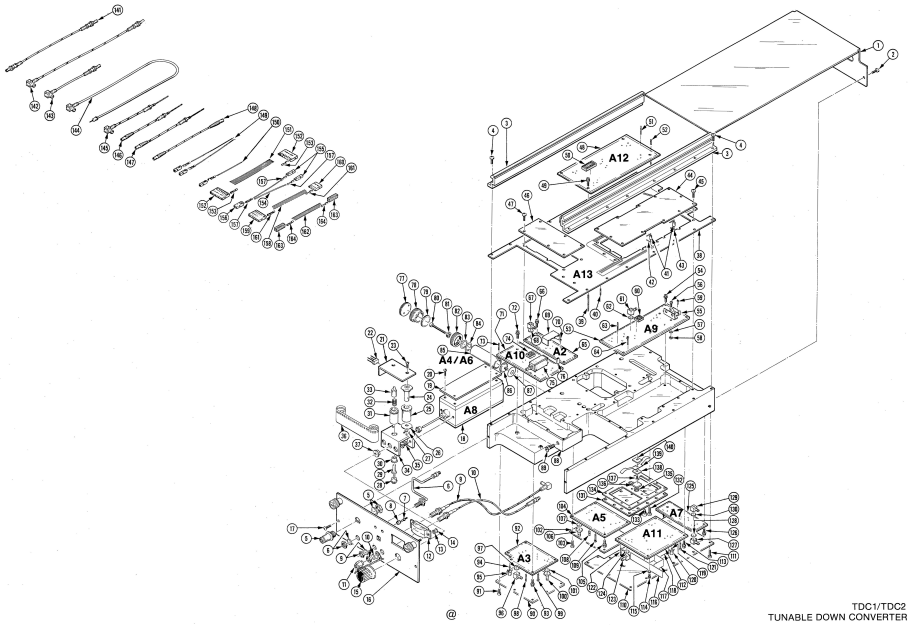
Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-27	210-1009-00	B010100	B010157	2	WASHER,FLAT:0.2 ID X 0.438 OD X 0.14 THK		
	210-1009-00	B010158		4	WASHER,FLAT:0.2 ID X 0.438 OD X 0.14 THK (TDC1 ONLY)		
	210-1009-00	B010100	B010130	2	WASHER,FLAT:0.2 ID X 0.438 OD X 0.14 THK		
	210-1009-00	B010131		4	WASHER,FLAT:0.2 ID X 0.438 OD X 0.14 THK (TDC2 ONLY)		
-28	401-0464-00	B010100	B010104	1	GEAR SET,BEVEL:2,18 TOOTH,NYLON		
	214-0535-00	B010105		2	GEAR,BEVEL:15 TOOTH,BRASS		
	213-0076-00			2	.SETSCREW:2-56 X 0.125,STL		
-29	384-1547-00	B010100	B010157	1	SHAFT,SPROCKET:0.79 L X 0.183 OD,AL		
	384-1547-02	B010158	B010543	1	SHAFT,SPROCKET:0.79 L X 0.183 OD,AL (TDC1 ONLY)		
	384-1547-00	B010100	B010130	1	SHAFT,SPROCKET:0.79 L X 0.183 OD,AL		
	384-1547-02	B010131	B010384	1	SHAFT,SPROCKET:0.79 L X 0.183 OD,AL (TDC2 ONLY)		
-30	401-0463-00	B010100	B010157	1	BEARING,SLEEVE:0.187 ID X 0.201 THK,ACETAL, 0.263 OD		
	401-0515-00	B010158		1	BEARING,SLEEVE:0.125 ID X 0.375 OD X 0.27 L (TDC1 ONLY)		
	401-0463-00	B010100	B010130	1	BEARING,SLEEVE:0.187 ID X 0.201 THK,ACETAL, 0.263 OD		
	401-0515-00	B010131		1	BEARING,SLEEVE:0.125 ID X 0.375 OD X 0.27 L (TDC2 ONLY)		
-31	214-0520-01	B010100	B010157	1	SPROCKET WHEEL:0.47 OD,8 TOOTH AL ANODIZED		
	214-0520-05	B010158	B010543	1	SPROCKET WHEEL:0.47 OD,8 TOOTH,AL,ANODIZED		
	214-0520-07	B010544		1	SPROCKET WHEEL:0.4700,8 TOOTH,AL,ANODIZED (TDC1 ONLY)		
	214-0520-01	B010100	B010130	1	SPROCKET WHEEL:0.47 OD,8 TOOTH AL ANODIZED		
	214-0520-05	B010131	B010384	1	SPROCKET WHEEL:0.47 OD,8 TOOTH,AL,ANODIZED		
	214-0520-07	B010385		1	SPROCKET WHEEL:0.4700,8 TOOTH,AL,ANODIZED (TDC2 ONLY)		
	213-0048-00	B010100	B010543	2	.SETSCREW:4-40 X 0.125,STL .(TDC1 ONLY)		
	213-0048-00	B010100	B010384	2	.SETSCREW:4-40 X 0.125,STL .(TDC2 ONLY)		
-32	214-3008-00			1	SPRING,HLCPS:0.261 OD X 0.375 L,CLE,MUW		
-33	214-2940-00			1	PLUNGER,DETENT:ACETAL		
-34	380-0585-00	B010100	B010157	1	HOUSING,DIAL:ALUMINUM		
	380-0585-01	B010158	B010543	1	HOUSING,DIAL:ALUMINUM TDC1		
	380-0585-02	B010544		1	HOUSING,DIAL:ALUMINUM (TDC1 ONLY)		
	380-0585-00	B010100	B010130	1	HOUSING,DIAL:ALUMINUM		
	380-0585-01	B010131	B010384	1	HOUSING,DIAL:ALUMINUM TDC1		
	380-0585-02	B010385		1	HOUSING,DIAL:ALUMINUM (TDC2 ONLY) (ATTACHING PARTS)		
-35	211-0510-00	B010100	B010543	2	SCREW,MACHINE:6-32 X 0.375,PNH,STL		
	211-0658-00	B010544		2	SCR,ASSEM WSHR:6-32 X 0.312,PNH,STL,POZ (TDC1 ONLY)		
	211-0510-00	B010100	B010384	2	SCREW,MACHINE:6-32 X 0.375,PNH,STL		
	211-0658-00	B010385		2	SCR,ASSEM WSHR:6-32 X 0.312,PNH,STL,POZ (TDC2 ONLY) (END ATTACHING PARTS)		
-36	331-0548-01	B010100	B010477	1	DIAL,SCALE:VHF CHANNELS		
	331-0387-00	B010478		1	DIAL,SCALE:VHF (TDC1 ONLY) (TDC2 ONLY)		
	331-0549-01			1	DIAL,SCALE:UHF CHANNELS		
-37	401-0462-00	B010100	B010173	1	BEARING,SLEEVE:0.128 ID X 0.18 THK,TEFLON,0 .264 OD		
	401-0496-00	B010174		1	BEARING,SLEEVE:0.125 ID X 0.312 OD,BRZ (TDC1 ONLY)		
	401-0462-00	B010100	B010147	1	BEARING,SLEEVE:0.128 ID X 0.18 THK,TEFLON,0 .264 OD		
	401-0496-00	B010148		1	BEARING,SLEEVE:0.125 ID X 0.312 OD,BRZ (TDC2 ONLY)		
-38	----- -----			1	CKT BOARD ASSY:INTERFACE(SEE A13 REPL)		
-39	131-0590-00			10	.TERMINAL,PIN:0.71 L X 0.025 SQ PH BRZ		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-40	131-0608-00			10	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL		
-41	----- -----			12	.CAP.,FXD,CER DI:(SEE A13C31,A13C32, .A13C55,A13C58,A13C64,A13C65,A13C66, .A13C67,A13C68,A13C73,A13C75,A13C85 REPL)		
-42	131-2441-00			9	.TERMINAL,PIN:1.0 L X 0.025 SQ,BRASS		
-43	131-0593-00			3	.TERMINAL,PIN:1.15 L X 0.025 SQ BRS TIN PL		
-44	337-2642-00			1	SHIELD,ELEC:CIRCUIT BOARD (ATTACHING PARTS)		
-45	213-0774-00			12	SCREW,TPG,TF:M3-0.5 X 10MM L,PNH,TAPTITE (END ATTACHING PARTS)		
-46	337-2640-00			1	SHIELD,ELEC:CIRCUIT BOARD (ATTACHING PARTS)		
-47	213-0774-00			6	SCREW,TPG,TF:M3-0.5 X 10MM L,PNH,TAPTITE (END ATTACHING PARTS)		
-48	----- -----			1	CKT BOARD ASSY:PIN DRIVER(SEE A12 REPL) (ATTACHING PARTS)		
-49	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:		
-50	136-0260-02	B010100	B010202	3	.SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP		
	136-0729-00	B010202		3	.SKT,PL-IN ELEK:MICROCKT,16 CONTACT .(TDC1 ONLY)		
	136-0260-02	B010100	B010150	3	.SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP		
	136-0729-00	B010151		3	.SKT,PL-IN ELEK:MICROCKT,16 CONTACT .(TDC2 ONLY)		
-51	131-0589-00			5	.TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL		
-52	136-0263-04			12	.SOCKET,PIN TERM:U/W 0.025 SQ PIN		
-53	----- -----			1	CKT BOARD ASSY:PHASE LOCK LOOP (SEE A9 REPL) (ATTACHING PARTS)		
-54	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:		
-55	136-0153-00			2	.SKT,PL-IN ELEK:CRYSTAL,2 CONT W/CLAMP .(TDC1 ONLY)		
	136-0153-00			1	.SKT,PL-IN ELEK:CRYSTAL,2 CONT W/CLAMP .(TDC2 ONLY) .(ATTACHING PARTS)		
-56	211-0022-00			4	.SCREW,MACHINE:2-56 X 0.188,PNH,STL .(TDC1 ONLY)		
	211-0022-00			2	.SCREW,MACHINE:2-56 X 0.188,PNH,STL .(TDC2 ONLY)		
-57	210-0001-00			4	.WASHER,LOCK:#2 INTL,0.013 THK,STL .(TDC1 ONLY)		
	210-0001-00			2	.WASHER,LOCK:#2 INTL,0.013 THK,STL .(TDC2 ONLY)		
-58	210-0405-00			4	.NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL .(TDC1 ONLY)		
	210-0405-00			2	.NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL .(TDC2 ONLY) .(END ATTACHING PARTS)		
-59	131-2415-00			5	.TERMINAL,STUD:0.25 L W/O INSULATION .(TDC1 ONLY)		
	131-2415-00			4	.TERMINAL,STUD:0.25 L W/O INSULATION .(TDC2 ONLY)		
-60	136-0514-00	B010100	B010229	2	.SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP .(TDC1 ONLY)		
	136-0514-00	B010100	B010177	2	.SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP .(TDC2 ONLY)		
-61	131-0265-00			1	.CONN,RCPT,ELEC:MINTR,CKT BD MTD,MALE,RTANG		
-62	210-1160-00			1	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-63	131-0589-00			2	.TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL		
-64	----- -----			4	.TERM,TEST POINT:(SEE A9TP38,A9TP73, .A9TP85,A9TP90 REPL)		
-65	----- -----			1	CKT BOARD ASSY:PIN ATTENUATOR (SEE A2 REPL) (ATTACHING PARTS)		
-66	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-67	131-1931-00			2	.CONN,RCPT,ELEC:SNAP CPLG,R ANGLE,CKT BD MT		
-68	210-1160-00			2	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-69	337-2704-01			1	.SHIELD,ELEC:CIRCUIT BOARD,BRASS		
	131-2531-00			1	.CONTACT,ELEC:GROUNDING		
-70	131-2415-00			2	.TERMINAL,STUD:0.25 L W/O INSULATION		
-71	----- -----			1	CKT BOARD ASSY:INDICATOR(SEE A10 REPL)		
					(ATTACHING PARTS)		
-72	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ		
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-73	131-0608-00			22	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL		
-74	136-0514-00			2	.SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP		
					.(TDC1 ONLY)		
	136-0514-00			1	.SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP		
					.(TDC2 ONLY)		
-75	----- -----			AR	.ACTR ASSY,PB:1 BUTTON(SEE A10S76 REPL)		
	131-0722-00			3	.CONTACT,ELEC:CAM SW,CU BE		
					.LAMP,INCAND:18V,0.026A,#CM7220,WIRED LED		
					.(SEE A1DS76 REPL)		
-76	131-0993-00			2	.BUS,CONDUCTOR:SHUNT ASSEMBLY,BLACK		
					.(TDC1 ONLY)		
	131-0993-00			1	.BUS,CONDUCTOR:SHUNT ASSEMBLY,BLACK		
					.(TDC2 ONLY)		
-77	214-2639-00			4	PLUG,COIL HSG:SHIELDING & TUNING		
-78	354-0564-00	B010100	B010103	4	RING,EXT THREAD:0.75-27 X 0.4 L,SST		
	354-0564-02	B010104		4	RING,EXT THREAD:0.75-27 X 0.3 L,STL CD PL		
-79	210-1039-00			4	WASHER,LOCK:0.521 ID,INT,0.025 THK,SST		
-80	211-0146-00			4	SCREW,CAP:4-40 X 1.312,SCH,SST,PVST,HEX REC		
-81	210-0586-00			4	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL		
-82	214-2542-00			4	PLUG,COIL HSG:SHIELD & TUNING		
-83	210-1015-00			4	WASHER,SPR TNSN:0.254 ID X 0.5 OD X 0.01 TH		
					K,STL		
-84	210-0978-00			4	WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL		
-85	----- -----			4	COIL,RF:FIXED,60NH,3.8 TURNS(SEE A4L52,		
					A4L57,A6L52,A6L57 REPL)		
-86	212-0629-00			4	SCREW,MACHINE:10-32 X 0.35 L,BDGH,STL		
-87	354-0567-00			4	RING,GROUNDING:0.55 OD X 0.42 ID X 0.01 THK		
-88	441-1487-00			1	CHAS,PL-IN UNIT:MAIN		
	213-0786-00			1	SETSCREW:10-32 X 0.25,SST		
-89	377-0498-00			1	INSERT,SCR THD:6-32 X 0.44 L,AL		
-90	337-2643-00			1	SHIELD,ELEC:CIRCUIT BOARD		
					(ATTACHING PARTS)		
-91	213-0774-00			1	SCREW,TPG,TF:M3-0.5 X 10MM L,PNH,TAPTITE		
					(END ATTACHING PARTS)		
-92	----- -----			1	CKT BOARD ASSY:FIRST MIXER(SEE A3 REPL)		
					(ATTACHING PARTS)		
-93	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ		
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-94	136-0252-07			1	.SOCKET,PIN CONN:W/O DIMPLE		
-95	131-1003-00			1	.CONN,RCPT,ELEC:CKT BD MT,3 PRONG		
-96	131-1931-00			1	.CONN,RCPT,ELEC:SNAP CPLG,R ANGLE,CKT BD MT		
-97	210-1160-00			1	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-98	131-0589-00			1	.TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL		
-99	----- -----			2	.TERM,TEST POINT:(SEE A3TP23,A3TP33 REPL)		
-100	----- -----			2	.CABLE ASSY,RF:(SEE W3,W10 REPL)		
-101	210-1160-00			2	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-102	337-2641-00			1	.SHIELD,ELEC:CIRCUIT BOARD		
					.(ATTACHING PARTS)		
-103	213-0774-00			5	.SCREW,TPG,TF:M3-0.5 X 10MM L,PNH,TAPTITE		
					.(END ATTACHING PARTS)		
-104	----- -----			1	CKT BOARD ASSY:I.F. AMPL(SEE A5 REPL)		
					(ATTACHING PARTS)		
-105	211-0152-00			4	SCR,ASSEM WSHR:4-40 X 0.625,PNH,BRS,NP,POZ		
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-106	131-0391-00			2	.CONN,RCPT,ELEC:SNAP-ON,MALE,BULK PACK		
-107	210-1160-00			2	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-108	136-0263-04			1	.SOCKET,PIN TERM:U/W 0.025 SQ PIN		
-109	----- -----			4	.TERM,TEST POINT:(SEE A5TP12,A5TP34, .A5TP52,A5TP92 REPL)		
-110	337-2639-00			1	SHIELD,ELEC:CIRCUIT BOARD (ATTACHING PARTS)		
-111	213-0774-00			18	SCREW,TPG,TF:M3-0.5 X 10MM L,PNH,TAPTITE (END ATTACHING PARTS)		
-112	----- -----			1	CKT BOARD ASSY:SECOND L.O.(SEE A11 REPL) (ATTACHING PARTS)		
-113	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ		
-114	211-0001-00			7	SCREW,MACHINE:2-56 X 0.25,PNH,STL		
-115	210-0001-00			7	WASHER,LOCK:#2 INTL,0.013 THK,STL (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:		
-116	337-2673-00	B010100	B010199	1	.SHIELD,ELEC:CIRCUIT BOARD .(TDC1 ONLY)		
	337-2673-01	B010200		1	.SHIELD,ELEC:CIRCUIT BOARD TDC1 .(TDC1 ONLY)		
	337-2673-00	B010100	B010149	1	.SHIELD,ELEC:CIRCUIT BOARD .(TDC2 ONLY)		
	337-2673-01	B010150		1	.SHIELD,ELEC:CIRCUIT BOARD TDC1 .(TDC2 ONLY)		
-117	337-2675-00			1	.SHIELD,ELEC:CIRCUIT BOARD		
-118	337-2672-00			1	.SHIELD,ELEC:CIRCUIT BOARD		
-119	136-0252-07			4	.SOCKET,PIN CONN:W/O DIMPLE		
-120	131-1003-00			1	.CONN,RCPT,ELEC:CKT BD MT,3 PRONG		
-121	----- -----			2	.TERM,TEST POINT:(SEE A11TP53,A11TP68)		
-122	131-2415-00			2	.TERMINAL,STUD:0.25 L W/O INSULATION		
-123	131-1841-00			2	.CONN,RCPT,ELEC:CKT BD,R ANGLE SNAP-ON		
-124	210-1160-00			2	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-125	----- -----			1	CKT BOARD ASSY:SECOND MIXER(SEE A7 REPL) (ATTACHING PARTS)		
-126	211-0116-00			6	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES:		
-127	131-1931-00			2	.CONN,RCPT,ELEC:SNAP CPLG,R ANGLE,CKT BD MT		
-128	210-1160-00			1	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-129	131-0951-00			1	.CONN,RCPT,ELEC:SNAP-ON,MALE		
-130	210-1160-00			1	.WASHER,FLAT:0.129 ID X 0.25 OD X 0.031		
-131	337-2415-01			2	SHIELD,ELEC:FILTER (ATTACHING PARTS)		
-132	211-0116-00			30	SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP,POZ		
-133	----- -----			4	SCREW,TUNING:0.234-64 X 0.36,DIELECTRIC (SEE A4C55,A6C55)		
-134	348-0539-00			2	GASKET:SHIELD & FILTER HOUSING		
-135	210-1035-00			4	WASHER,SPR TNSN:0.195 ID X 0.328 OD		
-136	361-0841-00			2	SPACER,BLOCK:0.078 X 0.4 X 0.365,AL		
-137	211-0213-00			2	SCREW,MACHINE:4-40 X 0.312,PNH,NYL		
-138	342-0373-00			2	INSULATOR,PLATE:TUNER,TOP,PLASTIC		
-139	----- -----			2	TUNING DVC,COIL:(SEE A4C55 REPL) TUNING DVC,COIL:(SEE A6C55 REPL)		
-140	342-0374-00			2	INSULATOR,PLATE:TUNER,BOTTOM,PLASTIC		
-141	----- -----			1	CABLE ASSY,RF:50 OHM COAX,6.0 L (SEE W2 REPL)		
-142	----- -----			1	CABLE ASSY,RF:50 OHM COAX,8.0 L (SEE W11 REPL)		
-143	----- -----			1	CABLE ASSY,RF:50 OHM COAX,2.5 L (SEE W9 REPL)		
-144	----- -----			1	CABLE ASSY,RF:50 OHM COAX,15.0 L (SEE W8 REPL)		
-145	----- -----			1	CABLE ASSY,RF:50 OHM COAX,4.5 L (SEE W5,W6 REPL)		
-146	----- -----			1	CABLE ASSY,RF:50 OHM COAX,5.0 L (SEE W4 REPL)		
-147	----- -----			1	CABLE ASSY,RF:50 OHM COAX,4.0 L (SEE W7 REPL)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-148	----- -----			1	CABLE ASSY,RF:50 OHM COAX,3.5 L (SEE W17,W18 REPL) CABLE ASSY,RF:50 OHM COAX,4.5 L (SEE W12 REPL) CABLE ASSY,RF:50 OHM COAX,5.0 L (SEE W14,W15 REPL)		
-149	175-2712-00			1	CA ASSY,SP,ELEC:2,26 AWG,5.0 L (TDC1 ONLY)		
	175-2758-00			1	CA ASSY,SP,ELEC:2,26 AWG,3.0 L		
-150	195-0450-00			3	LEAD,ELECTRICAL:26 AWG,2.5 L,4-N		
	195-0451-00	B010100	B010104	1	LEAD,ELECTRICAL:26 AWG,3.5 L,6-N		
	195-0451-00	B010105		2	LEAD,ELECTRICAL:26 AWG,3.5 L,6-N		
	195-0452-00	B010100	B010104	1	LEAD,ELECTRICAL:26 AWG,3.0 L,6-N		
	195-0451-00	B010105		2	LEAD,ELECTRICAL:26 AWG,3.5 L,6-N		
	195-0453-00	B010100	B010104	3	LEAD,ELECTRICAL:26 AWG,3.5 L,2-N		
	195-0453-00	B010105		4	LEAD,ELECTRICAL:26 AWG,3.5 L,2-N		
	195-0455-00	B010100	B010104	1	LEAD,ELECTRICAL:26 AWG,3.0 L,2-N		
	195-0453-00	B010105		4	LEAD,ELECTRICAL:26 AWG,3.5 L,2-N		
	195-0454-00			1	LEAD,ELECTRICAL:26 AWG,4.5 L,9-5 (TDC2 ONLY)		
-151	175-2711-00			1	CA ASSY,SP,ELEC:7,26 AWG,3.5 L		
-152	352-0166-00			2	.HLDR,TERM CONN:8 WIRE,BLACK		
-153	131-0707-00			16	.CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL		
-154	175-2604-00			2	CA ASSY,SP,ELEC:2,26 AWG,3.0 L		
-155	352-0171-00			4	.HLDR,TERM CONN:1 WIRE,BLACK		
-156	352-0169-00			2	.HLDR,TERM CONN:2 WIRE,BLACK		
-157	131-0707-00			8	.CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL		
-158	175-2605-00			1	CA ASSY,SP,ELEC:4,26 AWG,3.0 L		
-159	352-0165-00			1	.HLDR,TERM CONN:7 WIRE,BLACK		
-160	352-0162-00			1	.HLDR,TERM CONN:4 WIRE,BLACK		
-161	131-0707-00			8	.CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL		
-162	175-2603-00			1	CA ASSY,SP,ELEC:4,26 AWG,3.0 L (TDC1 ONLY)		
-163	352-0485-00			2	.HLDR,TERM CONN:4 WIRE,DBL ROW,BLACK		
-164	131-0707-00			8	.CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL		
					STANDARD ACCESSORIES		
	070-2754-00			1	MANUAL,TECH:INSTRUCTION		



TDC1/TDC2
TUNABLE DOWN CONVERTER